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CONTRACT REQUIREMENTS	CONTRACT ITEM	MODEL	CONTRACT NO.	DATE
		AG-US	84454	

REPORT

NO. XAR-A-45 DATE Aug. 26, 1963

EXPERIMENTAL STUDY OF HIGH SPEED HYDROFOILS

VOLUME II

PART IV

CODE 26512

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DATE	REV. BY	REVISIONS & ADDED PAGES	REMARKS

ENG. 344

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SUMMARY

This test program was conducted to measure the hydrodynamic characteristics of a series of transcavitating and supercavitating hydrofoil models with various planforms and sections to provide a design procedure to predict hydrodynamic characteristics for this type hydrofoil. Twenty hydrofoil models were tested in the Grumman Whirling Tank at three depths and at a sufficient number of speeds and angles of attack to fully define their hydrodynamic characteristics. Lift, drag, pitching moment, and strut base pressure were measured on all models, and cavity pressure and foil pressure were measured for the supercavitating models.

Classic supercavitating hydrofoil theory is shown to predict test results with an accuracy adequate for design if a modified value for the cross-flow lift coefficient is accepted.

INTRODUCTION

The work under this contract consisted of testing twenty supercavitating and transcavitating hydrofoil models in the Grumman Whirling Tank at three depths and at a sufficient number of speeds and angles of attack to fully define their hydrodynamic characteristics. The models include aspect ratios of 1.0 to 5.0, sweep angles of 0 to 56.3°, taper ratios of 0 to 1.0, design lift coefficients of 0 to .350, and were tested at cavitation numbers of .029 to .145. All models were mounted on a single 15% thick, blunt base parabolic strut except the aspect ratio = 5 model which was mounted on a twin strut combination

Lift, drag, pitching moment, and strut base pressure were measured for all models, and cavity pressure and foil base pressure were measured for the supercavitating models. The foil cavity pressure was measured by means of a static pressure tap centrally located on the upper surface of one semi-span.

Analysis of the test results was limited to the supercavitating lift and drag data; the transition from fully wetted to supercavitating did not cover significant angle of attack range on any foil tested. Transition from wetted to cavitated flow on these foils was characteristically accompanied by a very high frequency vibration audible as a loud screech. A study of this "singing" phenomenon did not conclusively identify the source but gave some indication that it was associated with a stall flutter type of instability.

The work of this contract has been submitted in three volumes. Volume I presents the measured results in tabular form, the correlation of results, the structural analysis, and an analysis of the "singing" phenomenon encountered during the tests. This volume presents the measured results in graphical form. Volume III summarizes the test results as a procedure for the prediction of the lift and drag for a supercavitating hydrofoil of arbitrary section and planform with a numerical example. Volume III is written as a complete summary report suited to wide distribution.

CONCLUSIONS

Classic supercavitating hydrofoil theory provides adequate correlation for these results if a modified value for the cross-flow lift coefficient is accepted. With the modified cross-flow lift coefficient, the correlation of the fifty-nine measured lift and drag curves with classic supercavitating hydrofoil theory may be summarized statistically as a prediction reliability (+ error indicates measurement higher than predicted):

	Mean Error	Probable Error
Lift Coefficient	-.002	±.012
Drag Coefficient	.0012	±.0028

DISCUSSION

The measured data is presented in graphical form in this section as plots of lift coefficient, drag coefficient, and pitching moment coefficient. The speeds specified are nominal. The actual speeds varied by about 5%, however, all data reduction was based upon the actual measured dynamic pressure.

The specified submergences are in mean geometric chords. The drag coefficients include strut drag. Moment coefficients are referenced to the quarter-chord of the mean geometric chord. The measured ventilated coefficients have not been corrected for cavity pressure and generally correspond to atmospheric cavity pressure.

U.S.C. [illegible]

Figures

Foil No.	Speed Knots	Fig. No. & Page No.	Foil No.	Speed Knots	Fig. No. & Page No.
1	40	IV.1	7	40	IV.35
	45	IV.2		45	IV.36
	50	IV.3		50	IV.37
	60	IV.4		60	IV.38
	70	IV.5		70	IV.39
	80	IV.6			
			8	40	IV.40
2	40	IV.7		45	IV.41
	45	IV.8		50	IV.42
	50	IV.9		60	IV.43
	60	IV.10		70	IV.44
	70	IV.11		80	IV.45
3	40	IV.12	9	40	IV.46
	45	IV.13		45	IV.47
	50	IV.14		50	IV.48
	60	IV.15		60	IV.49
	70	IV.16		70	IV.50
	80	IV.17		80	IV.51
4	40	IV.18	10	40	IV.52
	45	IV.19		45	IV.53
	50	IV.20			
	60	IV.21	11	40	IV.54
	70	IV.22		45	IV.55
	80	IV.23		50	IV.56
				60	IV.57
5	40	IV.24		70	IV.58
	45	IV.25		80	IV.59
	50	IV.26			
	60	IV.27	12	40	IV.60
	70	IV.28		45	IV.61
	80	IV.29		50	IV.62
				60	IV.63
6	40	IV.30		70	IV.64
	45	IV.31		80	IV.65
	50	IV.32			
	60	IV.33			
	70	IV.34			

[illegible]

LIST OF FIGURES (Cont'd.)

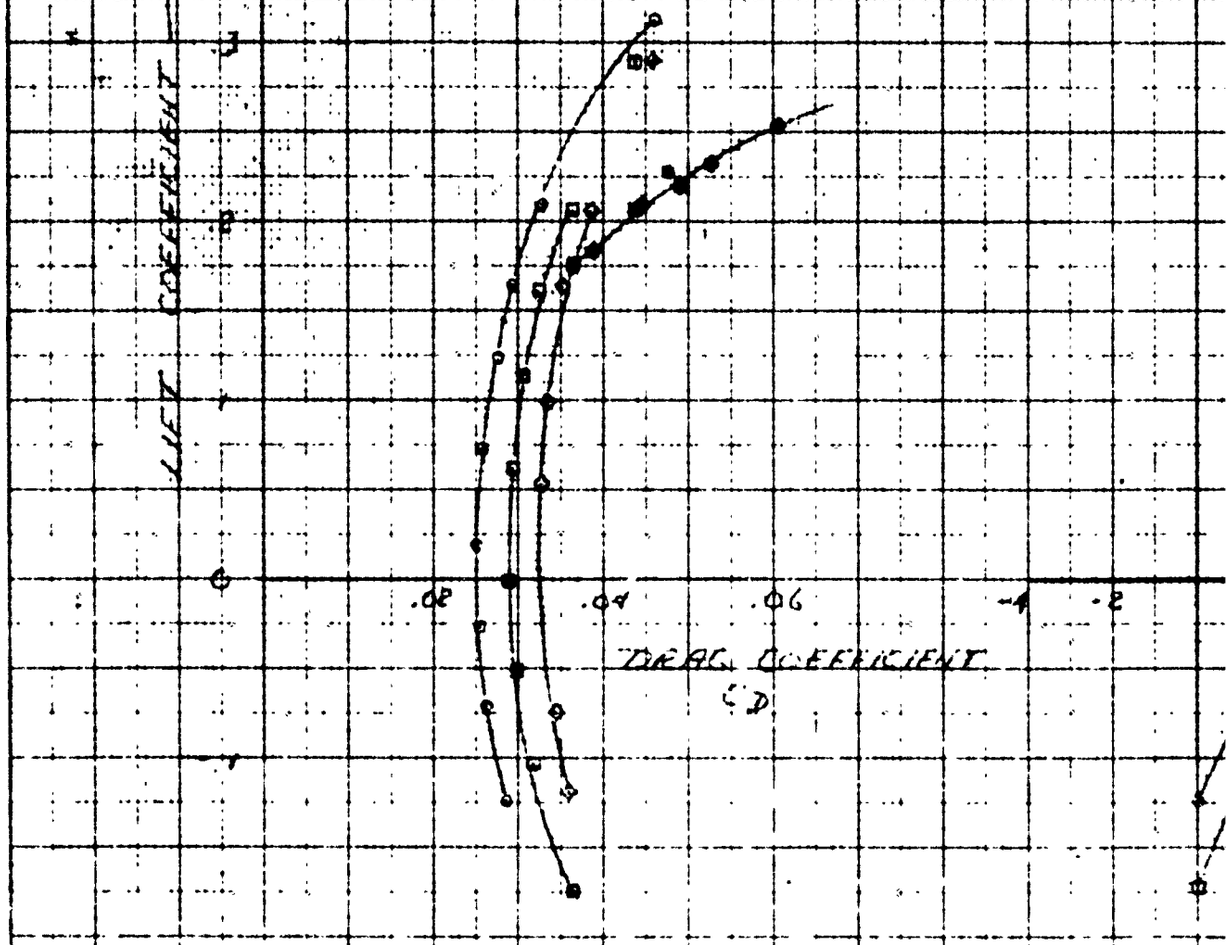
Foil No.	Speed Knots	Fig. No. & Page No.
13	40	IV.66
	45	IV.67
	50	IV.68
	60	IV.69
	70	IV.70
	80	IV.71
14	40	IV.72
	45	IV.73
	50	IV.74
	60	IV.75
	70	IV.76
	80	IV.77
15	40	IV.78
	45	IV.79
	50	IV.80
	60	IV.81
	70	IV.82
	80	IV.83
16	40	IV.84
	45	IV.85
	50	IV.86
	60	IV.87
	70	IV.88
	80	IV.89
17	40	IV.90
	45	IV.91
	50	IV.92
	60	IV.93
	70	IV.94
	80	IV.95
	90	IV.96
	96	IV.97
18	40	IV.98
	50	IV.99
	60	IV.100
	70	IV.101
	80	IV.102
	90	IV.103
	95	IV.104
19	40	IV.105
	50	IV.106
	60	IV.107
	70	IV.108
	80	IV.109
	90	IV.110
	96	IV.111
20	40	IV.112
	50	IV.113
	60	IV.114
	70	IV.115
	80	IV.116
	90	IV.117
	95	IV.118

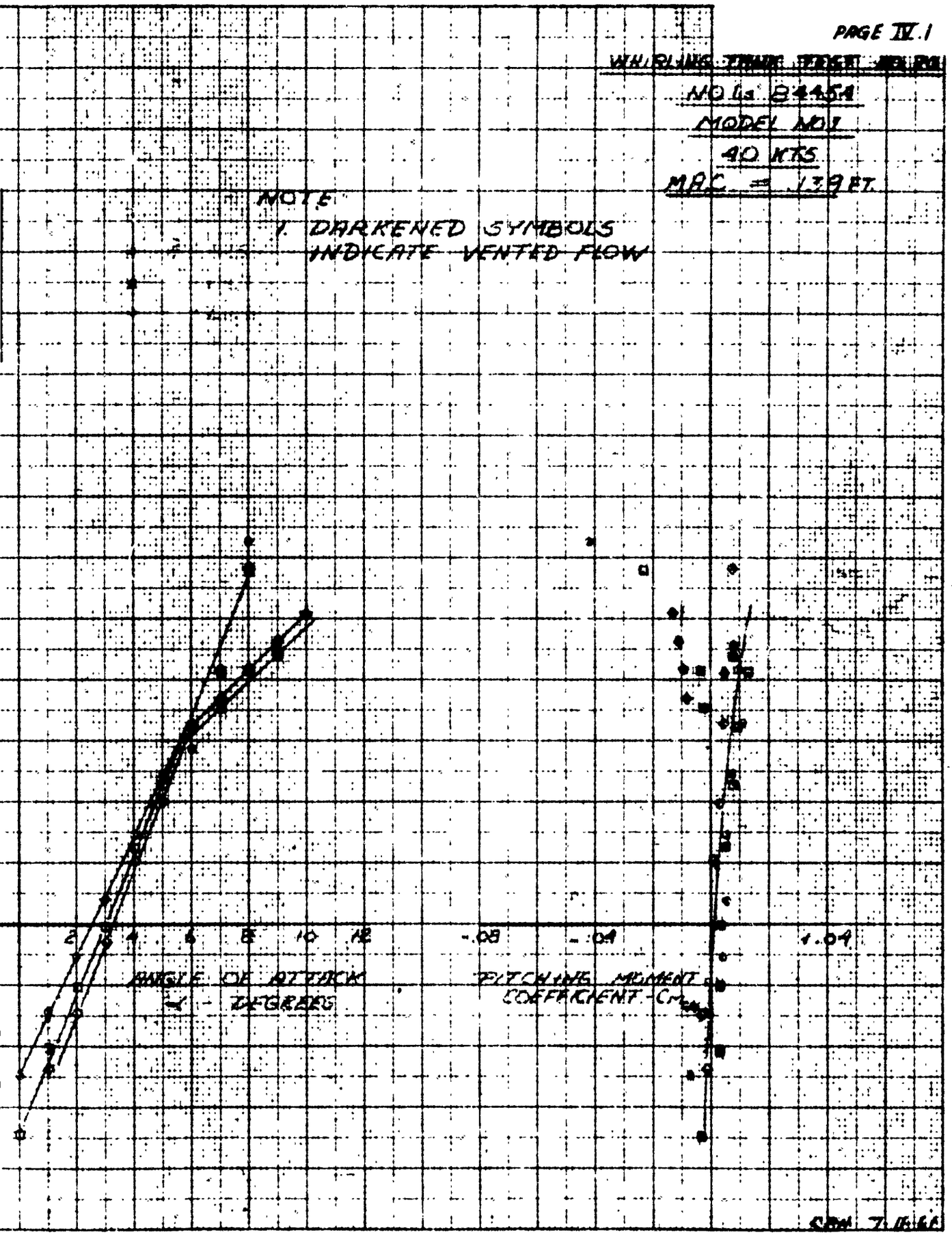
LIST OF FIGURES (Cont'd.)

Flapped Foil Tests

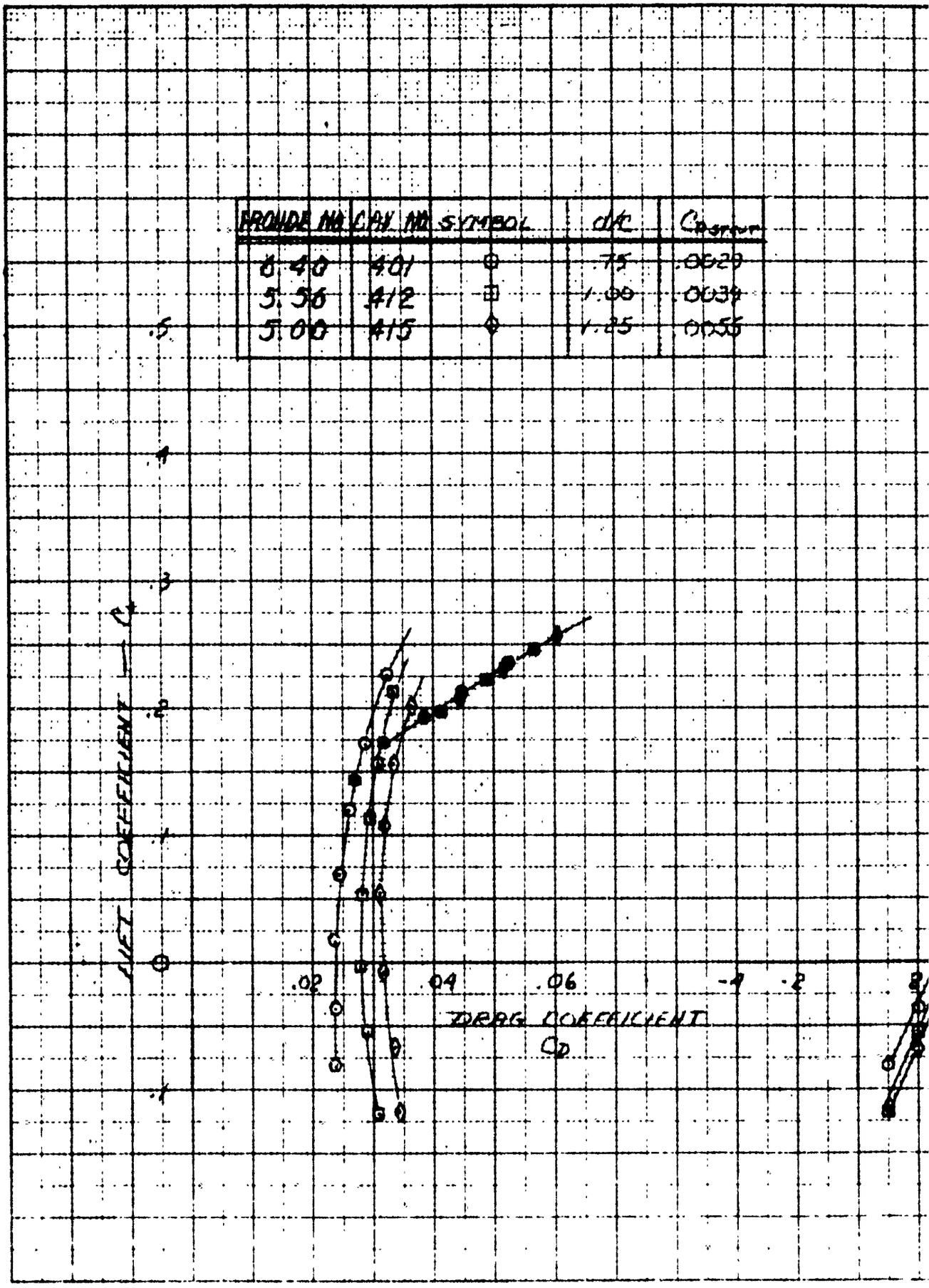
Foil No.	Speed Knots	d/c	Fig. No. & Page No.
13	40	.75	IV.119
		1.00	IV.120
		1.25	IV.121
	45	.75	IV.122
		1.00	IV.123
		1.25	IV.124
	50	.75	IV.125
		1.00	IV.126
		1.25	IV.127
	60	.75	IV.128
		1.00	IV.129
		1.25	IV.130
	70	.75	IV.131
		1.00	IV.132
		1.25	IV.133
	80	.75	IV.134
		1.00	IV.135
		1.25	IV.136
14	40	1.00	IV.137
	45		IV.138
	50		IV.139
	60		IV.140
	70		IV.141
	80		IV.142
15	40	1.00	IV.143
	45		IV.144
	50		IV.145
	60		IV.146
	70		IV.147
	80		IV.148

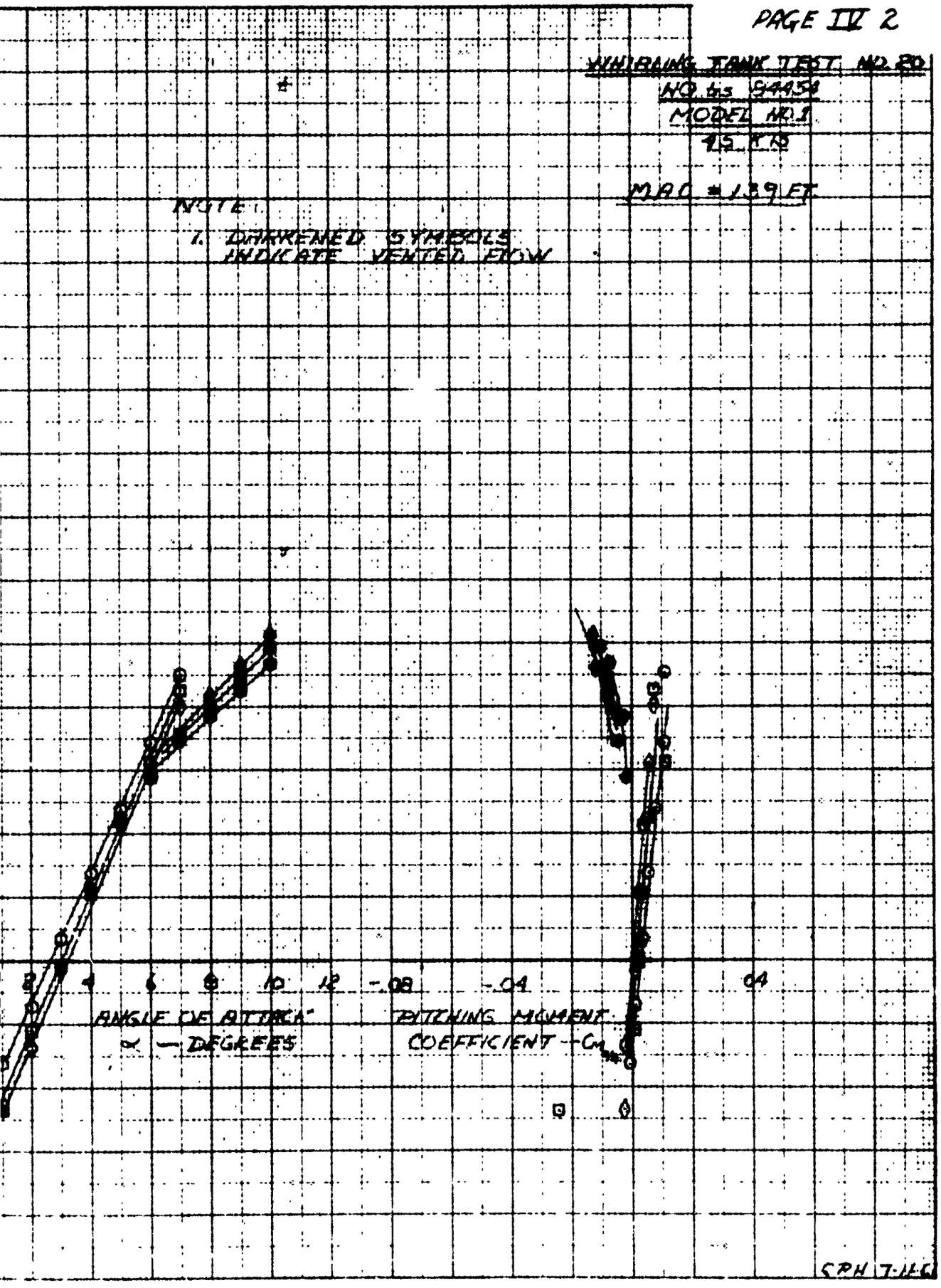
FROUDE NO.	SYMBOL	v/c	$C_{D_{STREUT}}$	CAV. NO.
6.40	○	.75	.0032	.491
5.56	□	1.00	.0042	.505
5.00	◇	1.25	.0056	.520

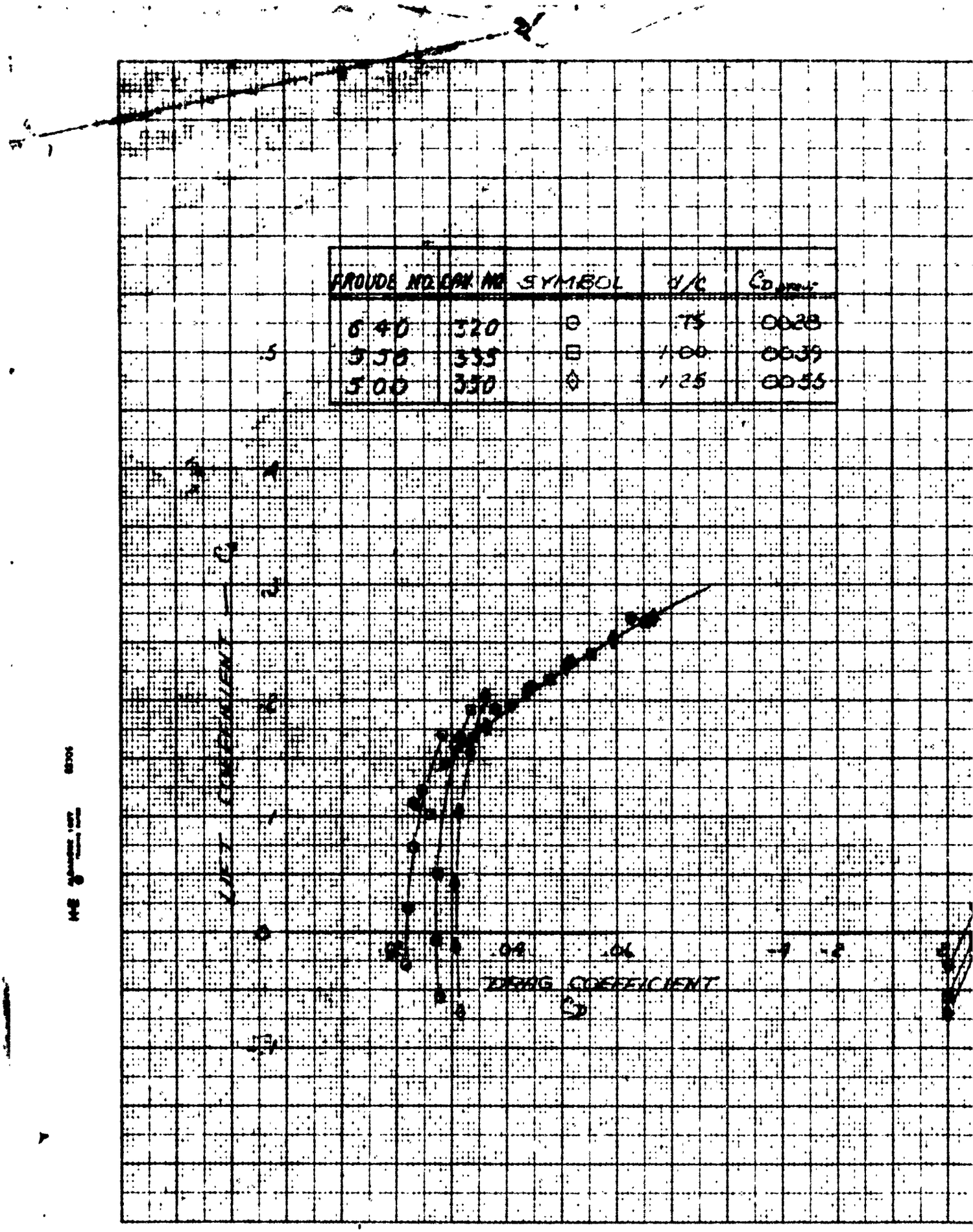



WHIRLING TANK TEST
NO Ls 84454
MODEL NO 1
40 KTS
MAC = .139 FT.
NOTE
1. DARKENED SYMBOLS INDICATE VENTED FLOW
2
4
6
8
10
12
-.08
-.04
+.04
ANGLE OF ATTACK
α - DEGREES
PITCHING MOMENT COEFFICIENT - $C_{m_{ac}}$

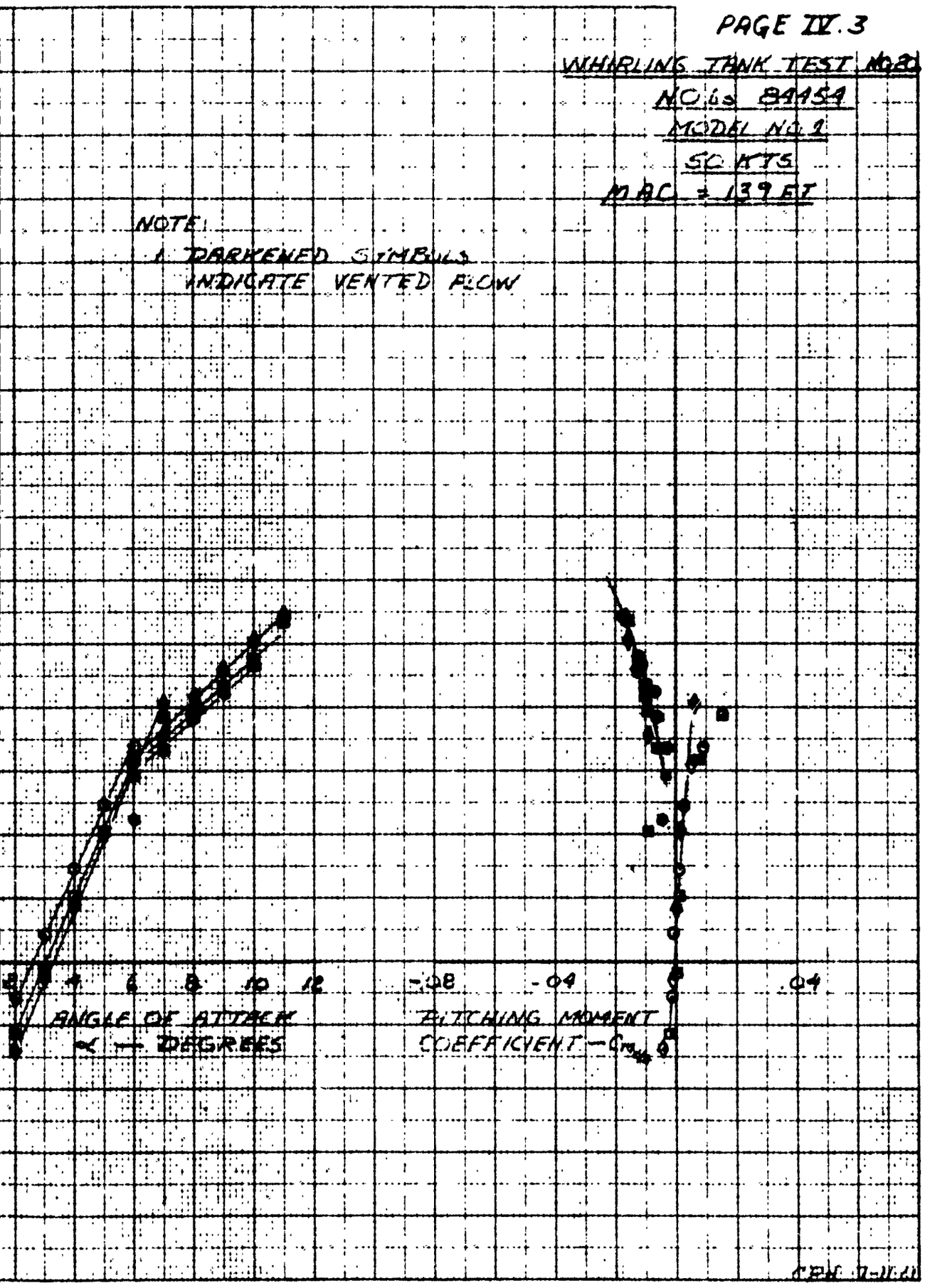
FROUDE NO.	CAV. NO.	SYMBOL	d/c	$C_{D_{min}}$
6.40	401	⊕	.75	.0029
5.56	412	⊡	1.00	.0039
5.00	415	◈	1.25	.0055




WHIRLING TANK TEST NO. 20
NO. bis 94454
MODEL NO. 1
45 KTS
MAC = 1.39 FT
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW
2
4
6
8
10
12
-.08
-.04
.04
ANGLE OF ATTACK
α — DEGREES
PITCHING MOMENT
COEFFICIENT — C_m
CPH 7-11-6



FROUDE NO. | CAV. NO. | SYMBOL | d/c | $C_{D_{max}}$
6.40 | 320 | ⊖ | .75 | .0028
5.50 | 335 | ⊟ | 1.00 | .0039
5.00 | 350 | ◇ | 1.25 | .0055
LIFT COEFFICIENT — C_L
DRAG COEFFICIENT C_D
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-.4
-.2


PAGE IV.3
WHIRLING TANK TEST NO.20
NO. 84454
MODEL NO. 1
50 KTS
MAC = 139 FT
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW
4
6
8
10
12
-.08
-.04
.04
ANGLE OF ATTACK
α — DEGREES
PITCHING MOMENT
COEFFICIENT — $C_{m_{\alpha/2}}$

FROUDE NO.	SYMBOL	d/c	C_{DRAG}	CAV NO.
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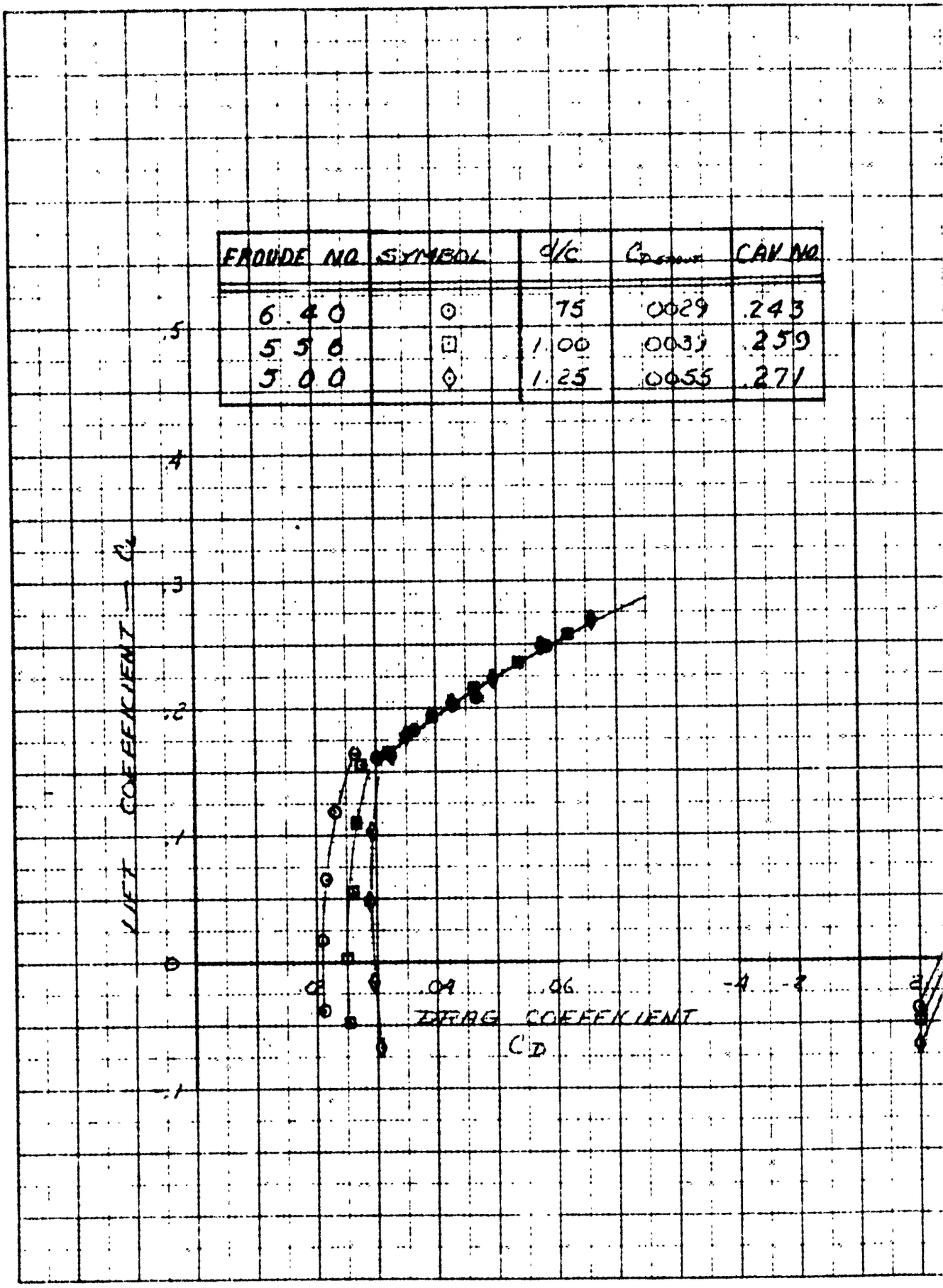
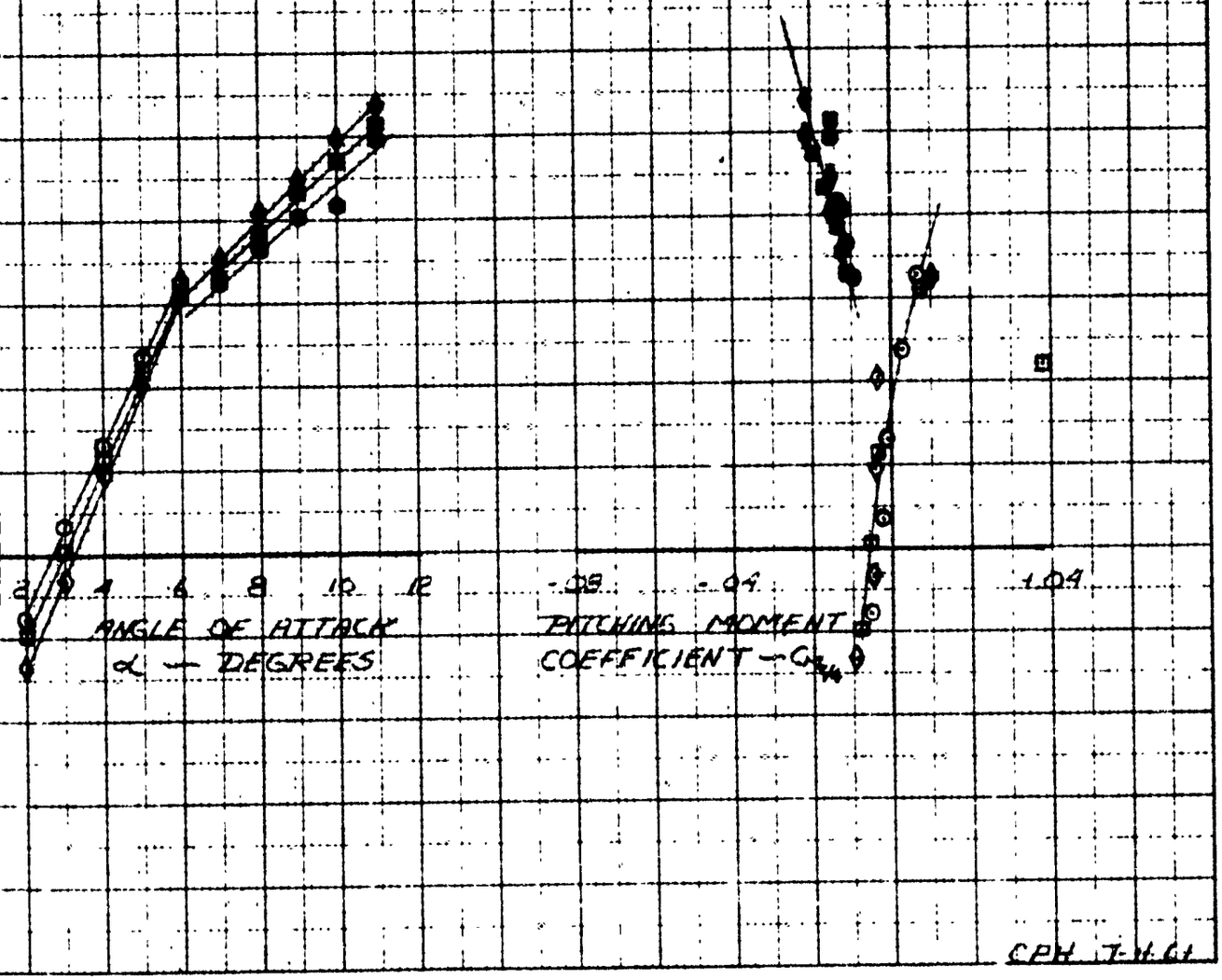
5.56	⊡	1.00	.0031	.259
5.00	◇	1.25	.0055	.271



WHIRLING TANK TEST NO 20
NOGs 84454
MODEL NO 1
60 KTS
M.A.C. = 12.9 E.I

NOTE.
1. DARKENED SYMBOLS INDICATE VENTED FLOW



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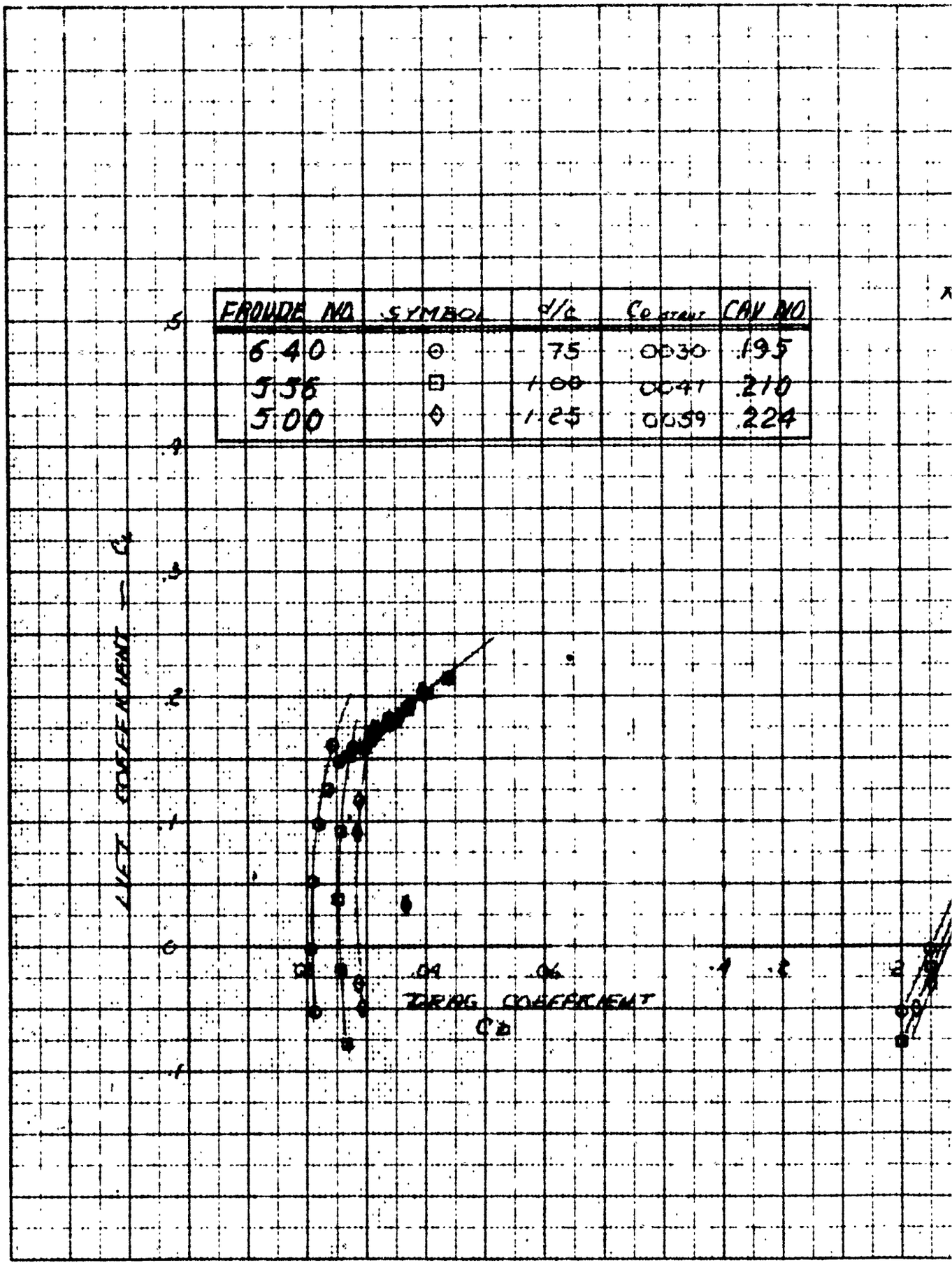
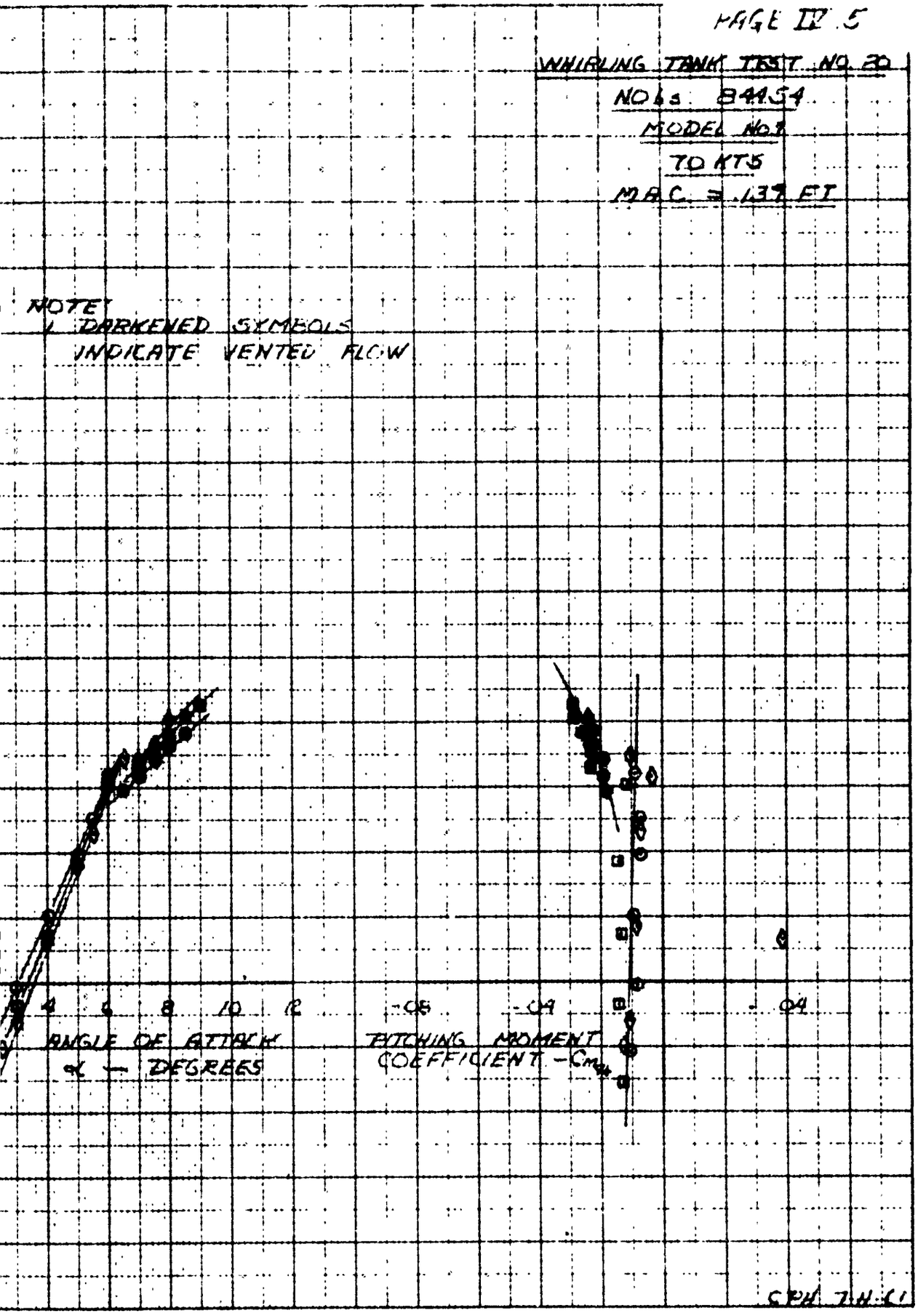
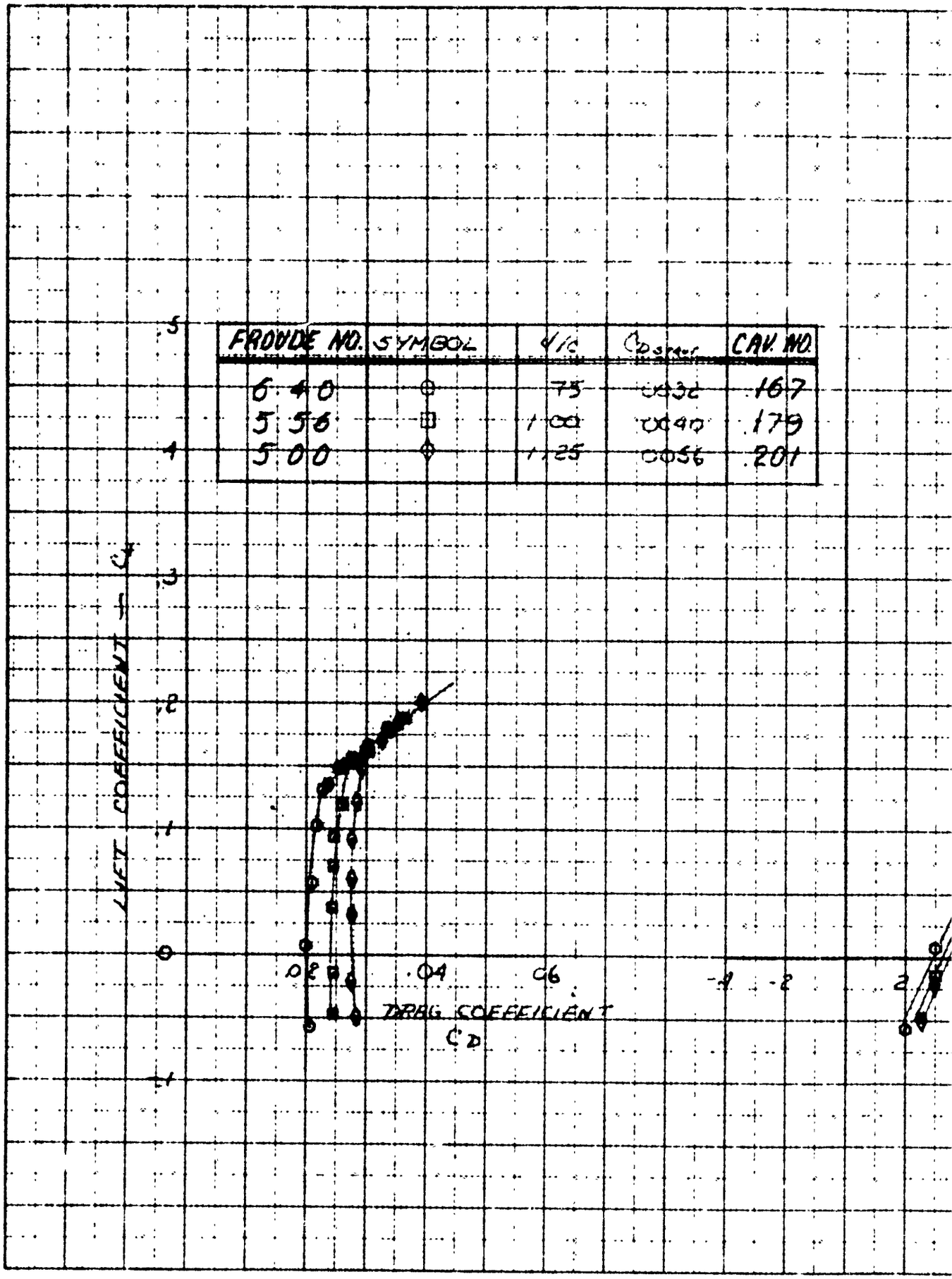
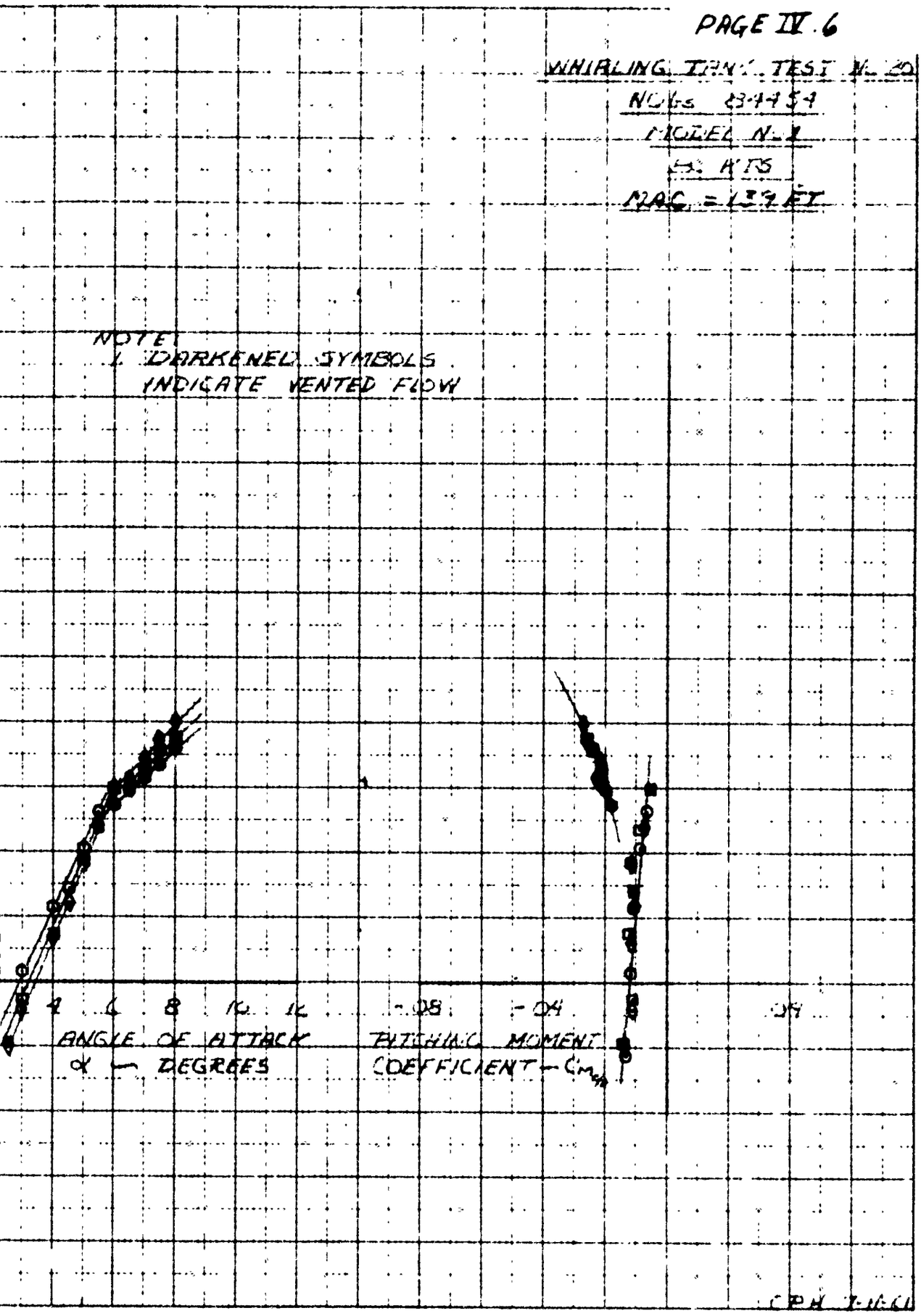
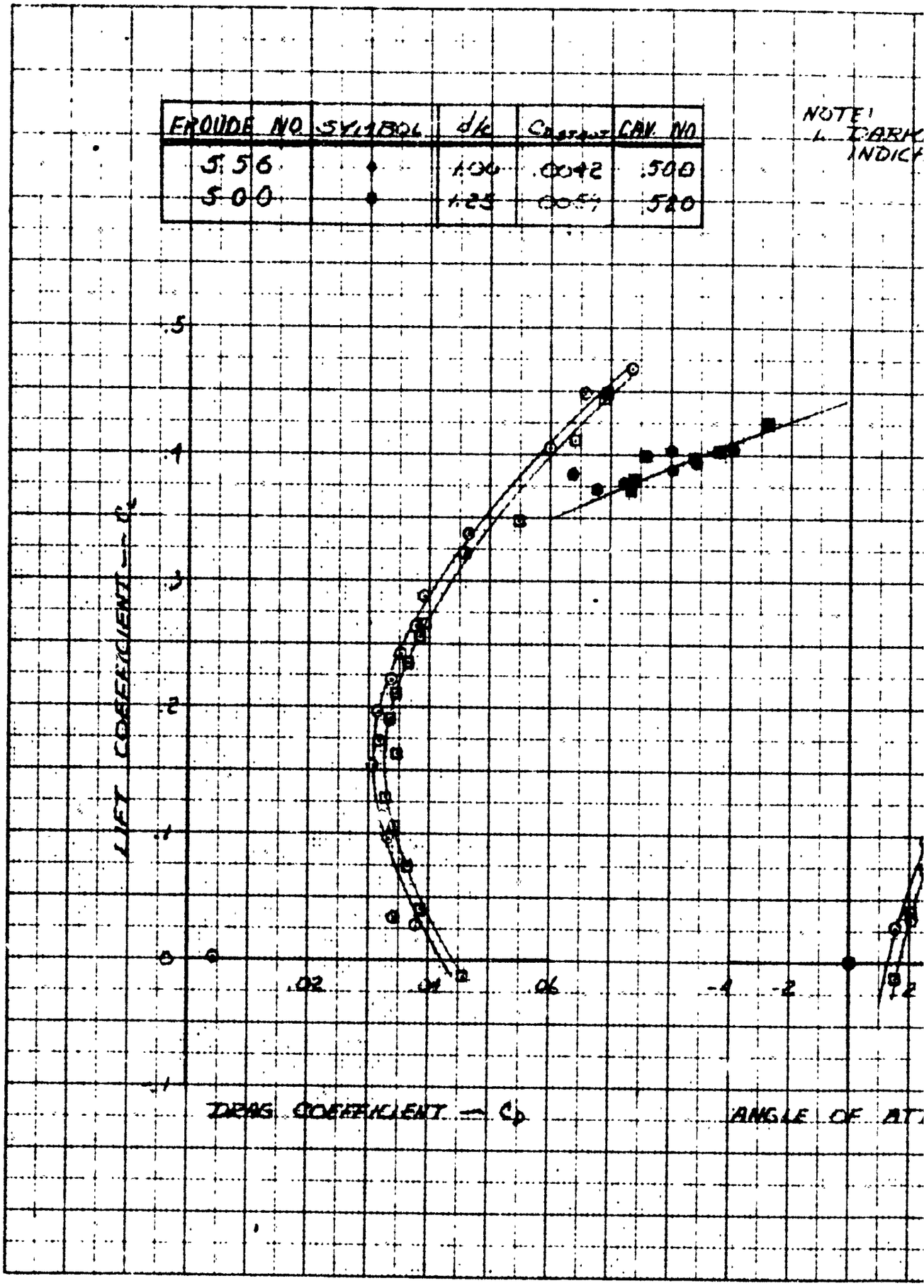
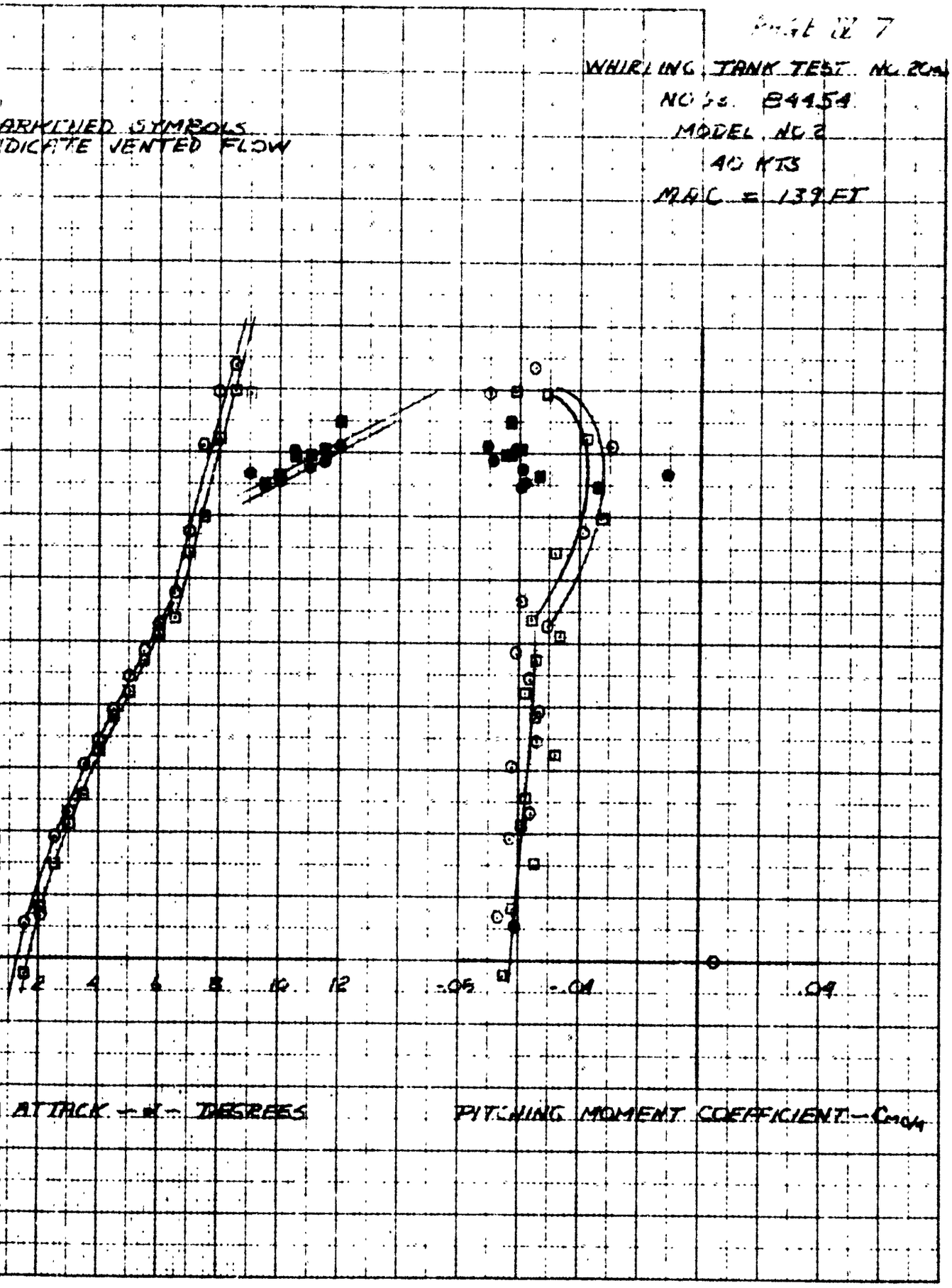

FROUDE NO
SYMBOL
d/c
Co
CAV NO
6.40
5.56
5.00
.75
1.00
1.25
.0030
.0041
.0039
.195
.210
.224
LIFT COEFFICIENT = CL
.5
.4
.3
.2
.1
0
-.1
.04
.06
.1
.2
DRAG COEFFICIENT
Cd

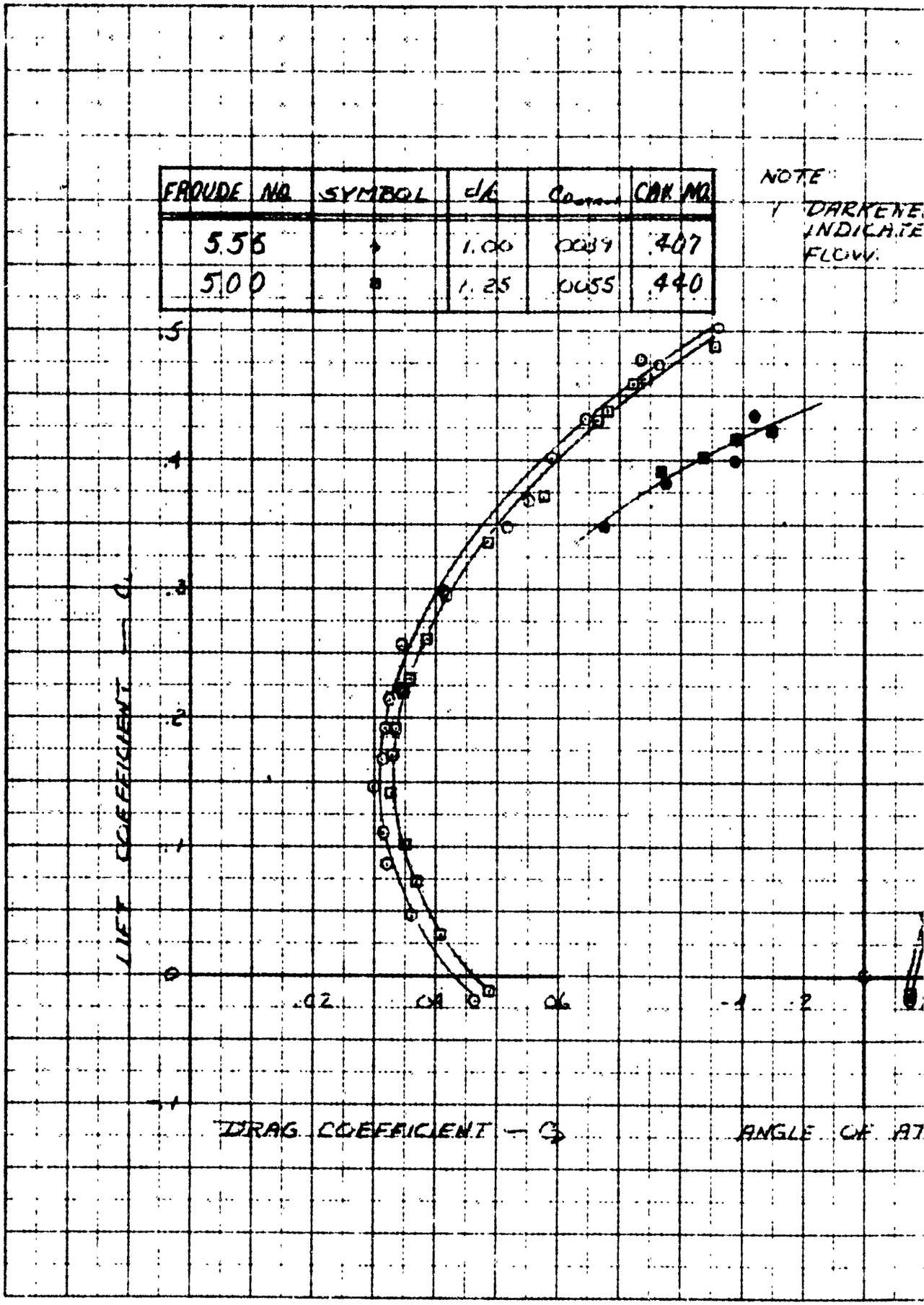

WHIRLING TANK TEST NO. 20
NO bs 84454
MODEL No 9
70 KTS
M.A.C. = .139 FT
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW
4
6
8
10
12
ANGLE OF ATTACK
α — DEGREES
-.08
-.04
-.04
PITCHING MOMENT COEFFICIENT - $C_{m_{ac}}$
CPH 7-H-61


FROUDE NO.
SYMBOL
d/c
$C_{D\,strut}$
CAV. NO.
6.40
.75
.0032
.167
5.56
1.00
.0040
.179
5.00
1.25
.0056
.201
LIFT COEFFICIENT — C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-.4
-.2
.2
DRAG COEFFICIENT
C_D


WHIRLING TANK TEST
NOGs 84454
MODEL
KTS
MAC = 139 FT
NOTE:
1. DARKENED SYMBOLS
INDICATE VENTED FLOW
4
6
8
10
12
-.08
-.04
.04
ANGLE OF ATTACK
α — DEGREES
PITCHING MOMENT
COEFFICIENT — $C_{m_{c/4}}$

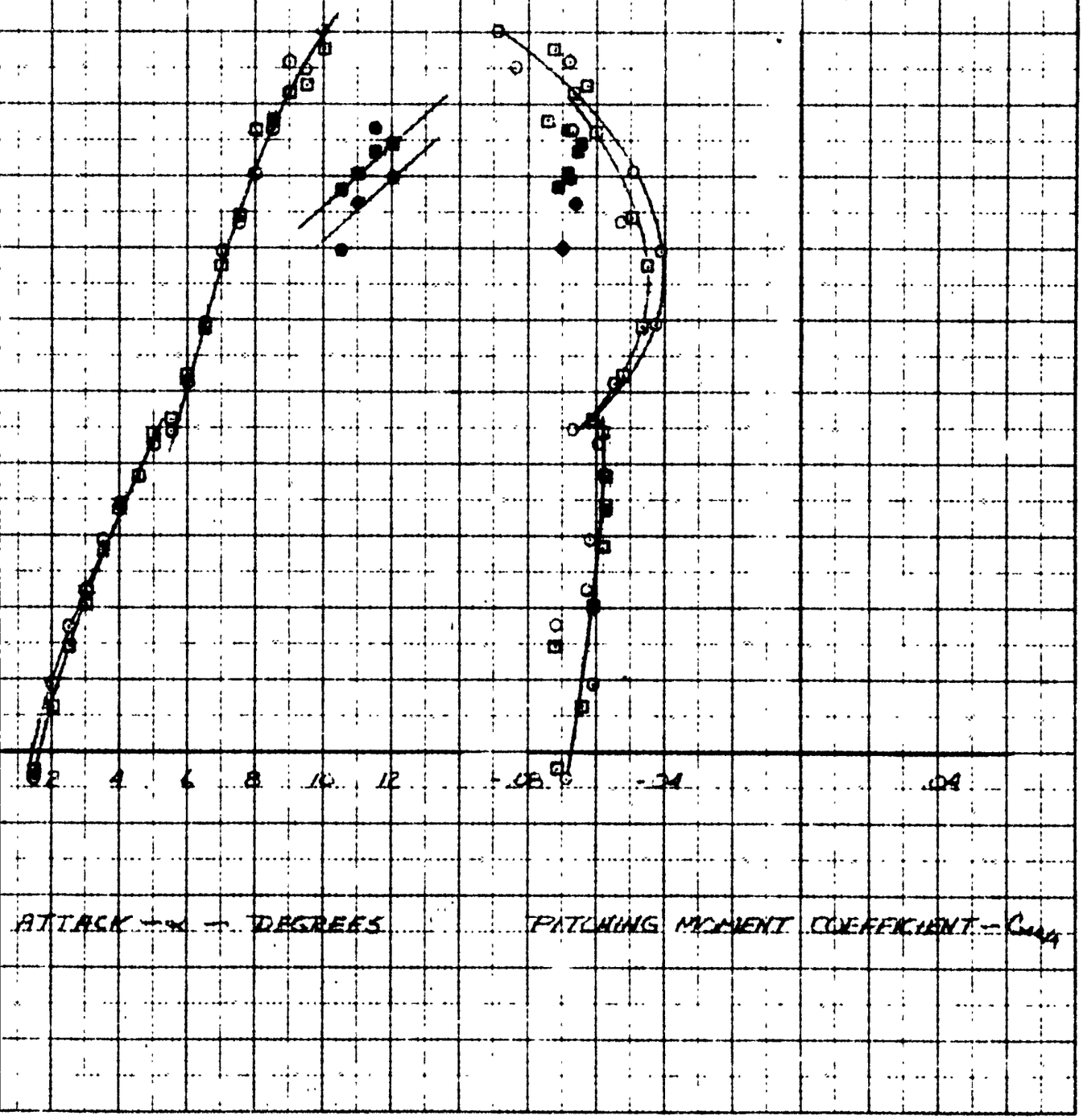

FROUDE NO
SYMBOL
d/c
CAV. NO
5.56
.0042
.500
5.00
1.25
.520
NOTE:
LIFT COEFFICIENT — C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-.4
-.2
.2
DRAG COEFFICIENT — C_D
ANGLE OF AT


PAGE IV 7
WHIRLING TANK TEST NO. 20a
NO. 84454
MODEL NO 2
40 KTS
MAC = 139 FT
ARKENED SYMBOLS
IDICATE VENTED FLOW
2
4
6
8
10
12
-.05
-.04
.04
ATTACK — α — DEGREES
PITCHING MOMENT COEFFICIENT — $C_{m_{c/4}}$


FROUDE NO
SYMBOL
d/A
CAV NO
5.56
1.00
.0089
.407
5.00
1.25
.0055
.440
NOTE
DARKENE
INDICATE
FLOW.
LIFT COEFFICIENT — C
DRAG COEFFICIENT — C
ANGLE OF AT
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-1
-2

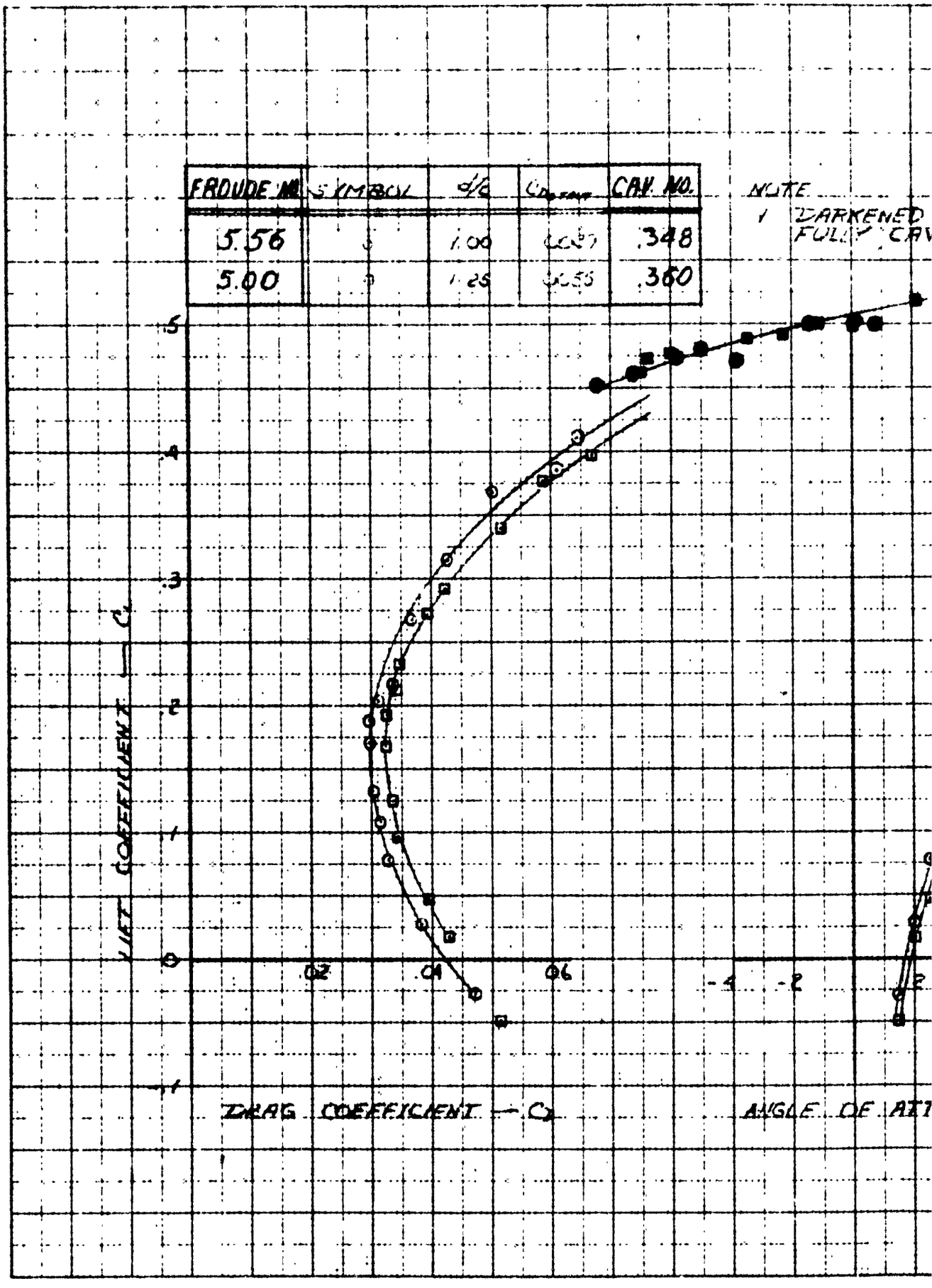
WHIRLING TANK TEST NO. 20a
NO 6s 84454
MODEL NO 2
45 KTS
MAC = .137 FT

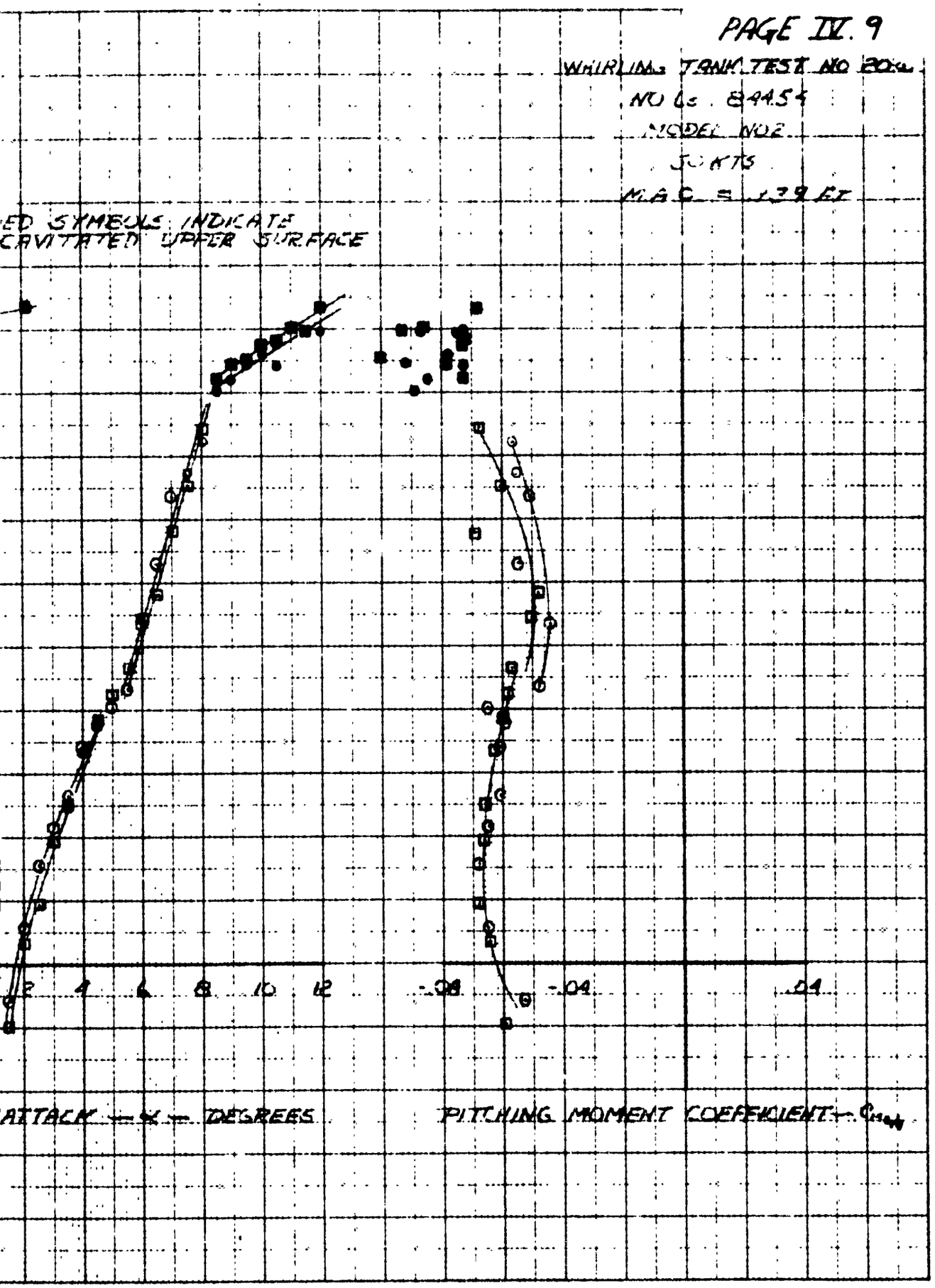
ENED SYMBOLS
HTE FULLY VENTED.

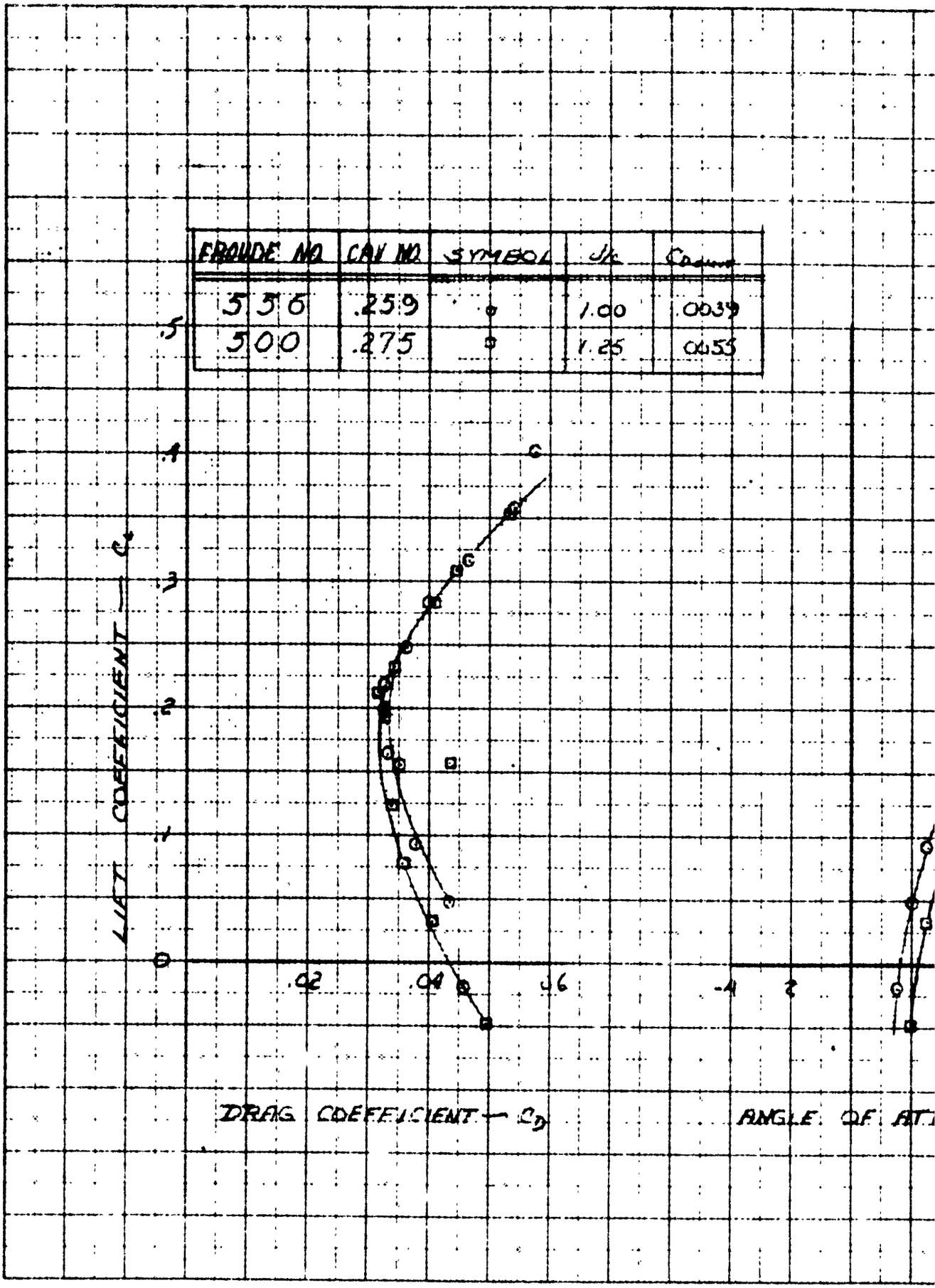


ATTACK — α — DEGREES

PITCHING MOMENT COEFFICIENT — $C_{m_{c/4}}$


FROUDE NO.
SYMBOL
d/c
CAV. NO.
5.56
1.00
.348
5.00
1.25
.360
NOTE
1 DARKENED
FULLY CAV
LIFT COEFFICIENT — C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-4
-2
2
DRAG COEFFICIENT — C_D
ANGLE OF ATT

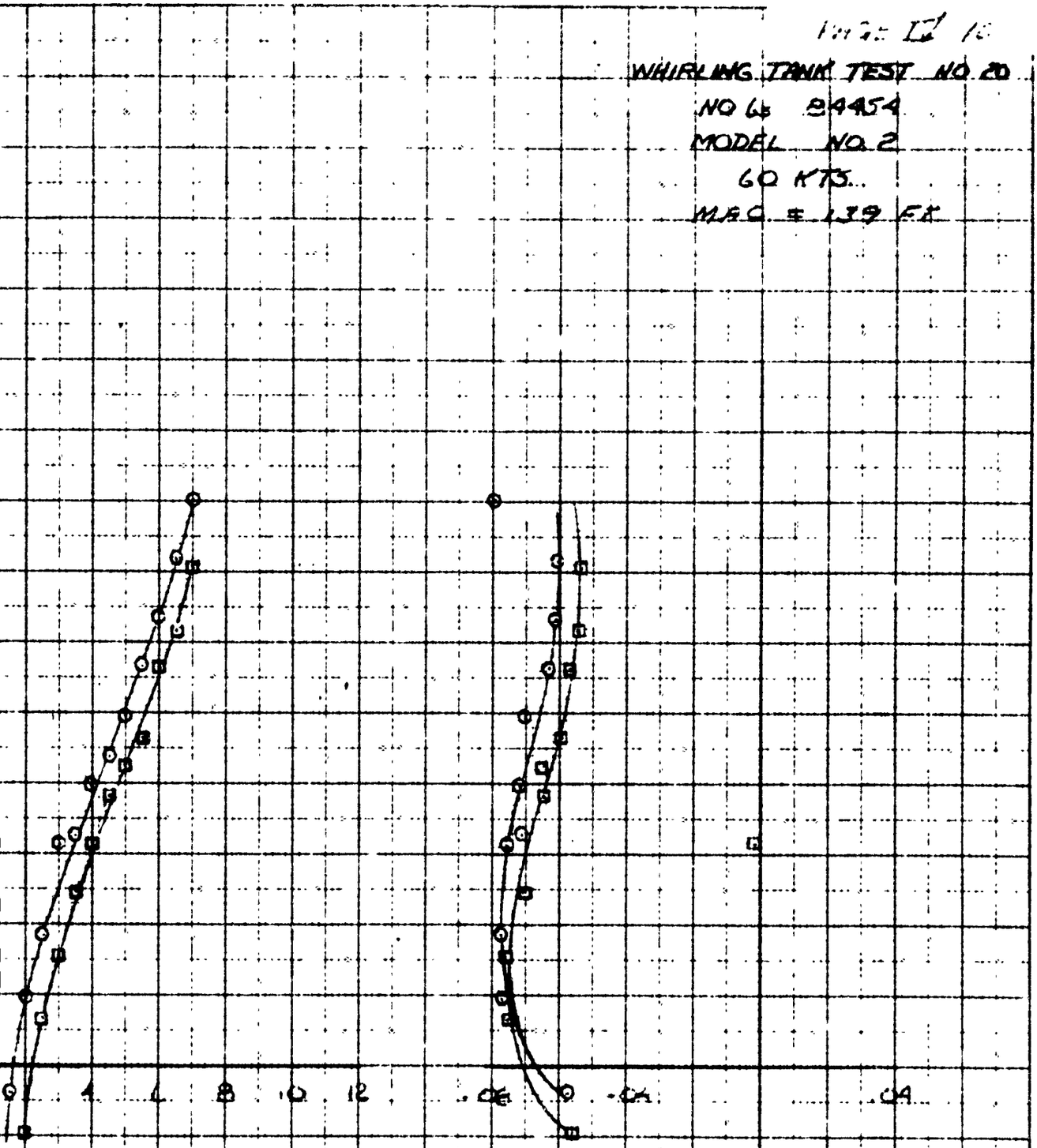

PAGE IV. 9
WHIRLING TANK TEST NO 20a
NO Cs 84454
MODEL NO2
50 KTS
M.A.C = .139 FT
ED SYMBOLS INDICATE
CAVITATED UPPER SURFACE
2
4
6
8
10
12
-.08
-.04
.04
ATTACK — α — DEGREES
PITCHING MOMENT COEFFICIENT — $C_{m_{c/4}}$



FROUDE NO
CAV NO
SYMBOL
J/c
$C_{D_{ave}}$
556
.259
1.00
.0039
500
.275
1.25
.0055
LIFT COEFFICIENT — C_L
.5
.4
.3
.2
.1
0
.02
.04
.06
-4
2
DRAG COEFFICIENT — C_D
ANGLE OF AT

Page IV 16

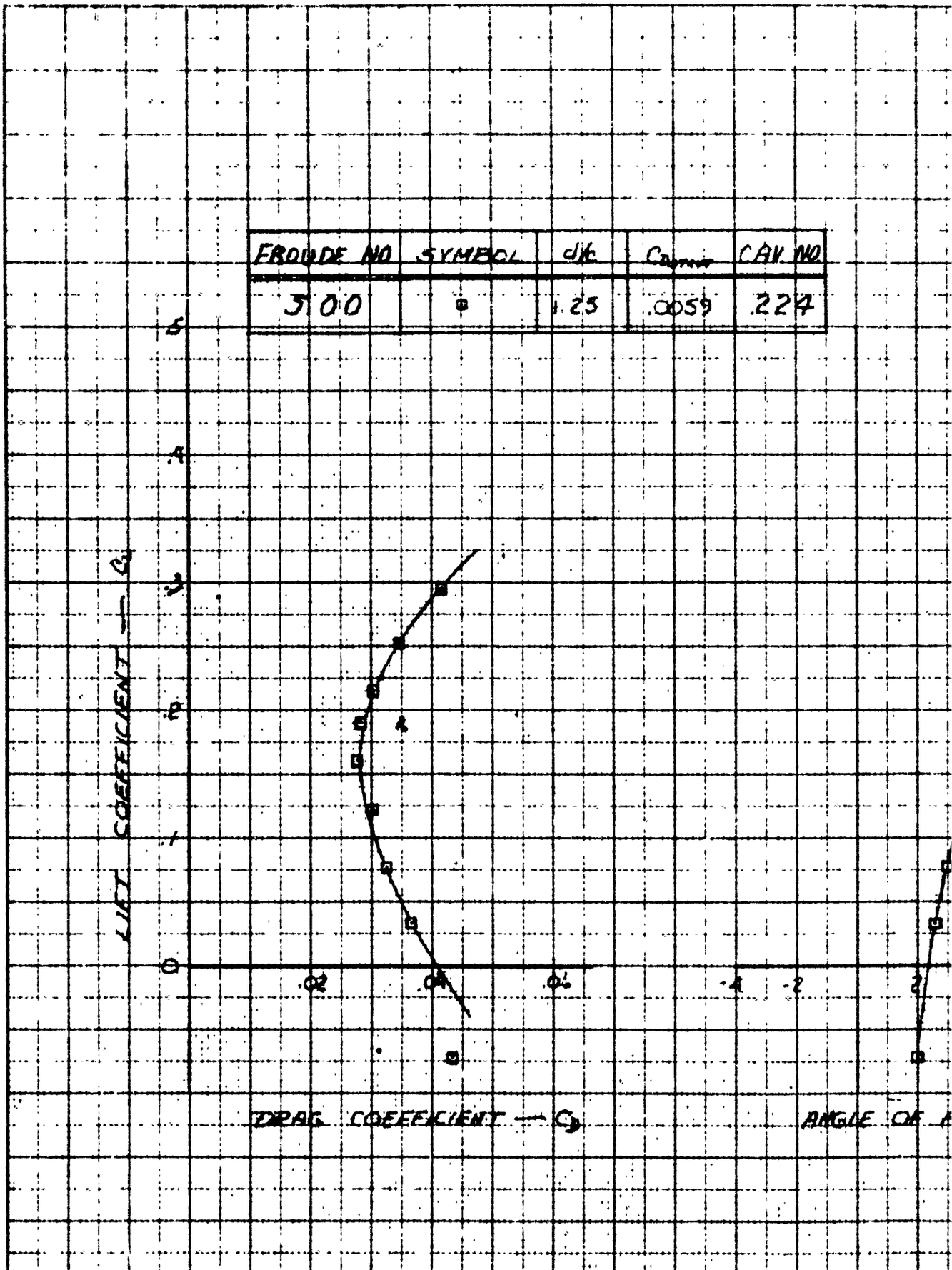
WHIRLING TANK TEST NO 20
NO 4 29454
MODEL NO 2
60 KTS.
M.A.C. = 1.39 FT



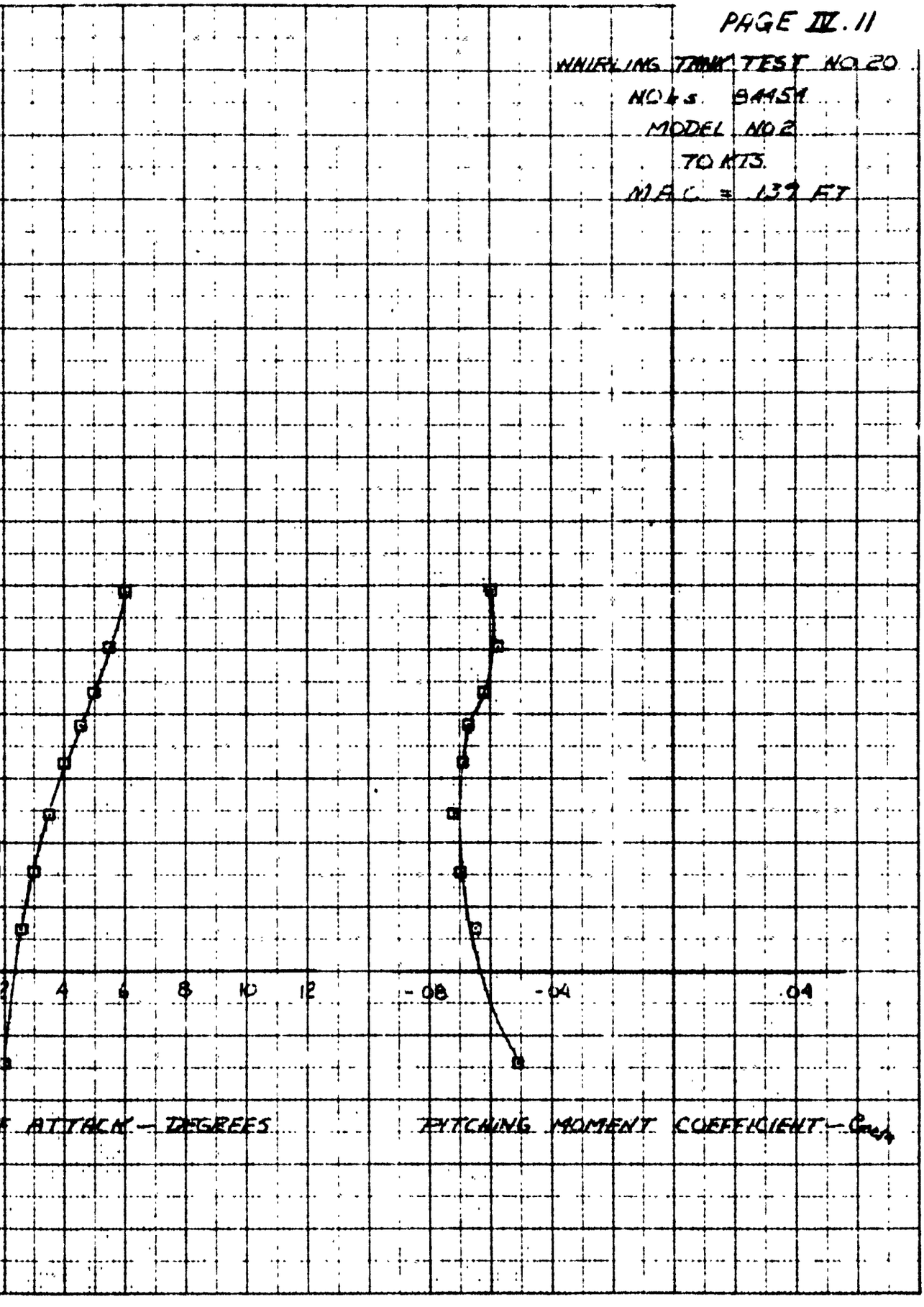
ATTACK — α — DEGREES

PITCHING MOMENT COEFFICIENT — $C_{m_{c/4}}$

FROUDE NO	SYMBOL	d/k	$C_{D_{min}}$	CAV. NO.
3.00	⊕	1.25	.0059	.227

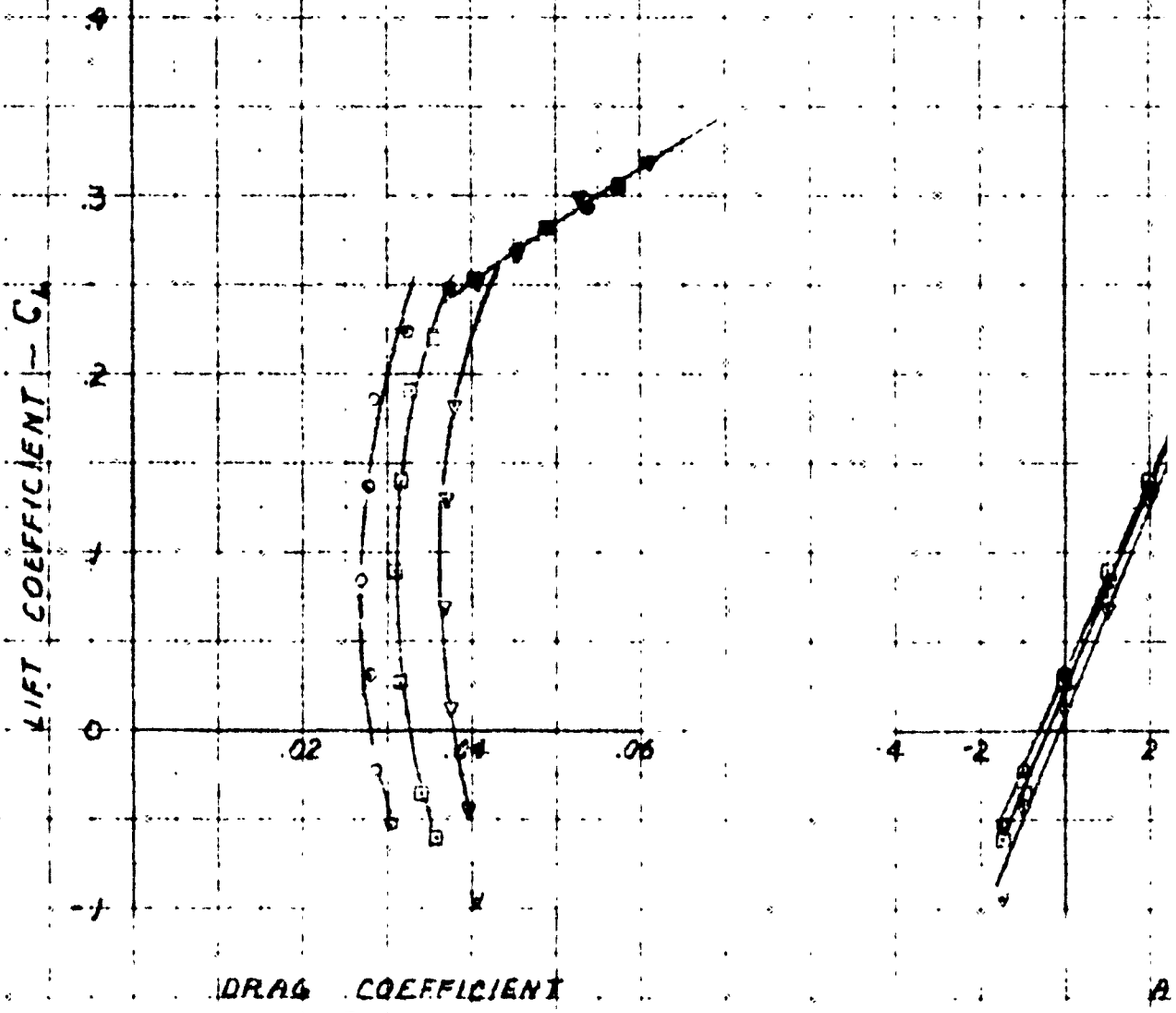


WHIRLING TANK TEST NO 20
NO 4s 8445A
MODEL NO 2
70 KTS.
M.A.C. = 1.37 FT



FROUDE NO.	SYMBOL	d/c	C_D STRUT	CAV NO
6.12	○	.75	.0023	.409
5.32	□	1.00	.0034	.515
4.79	▽	1.25	.0053	.532

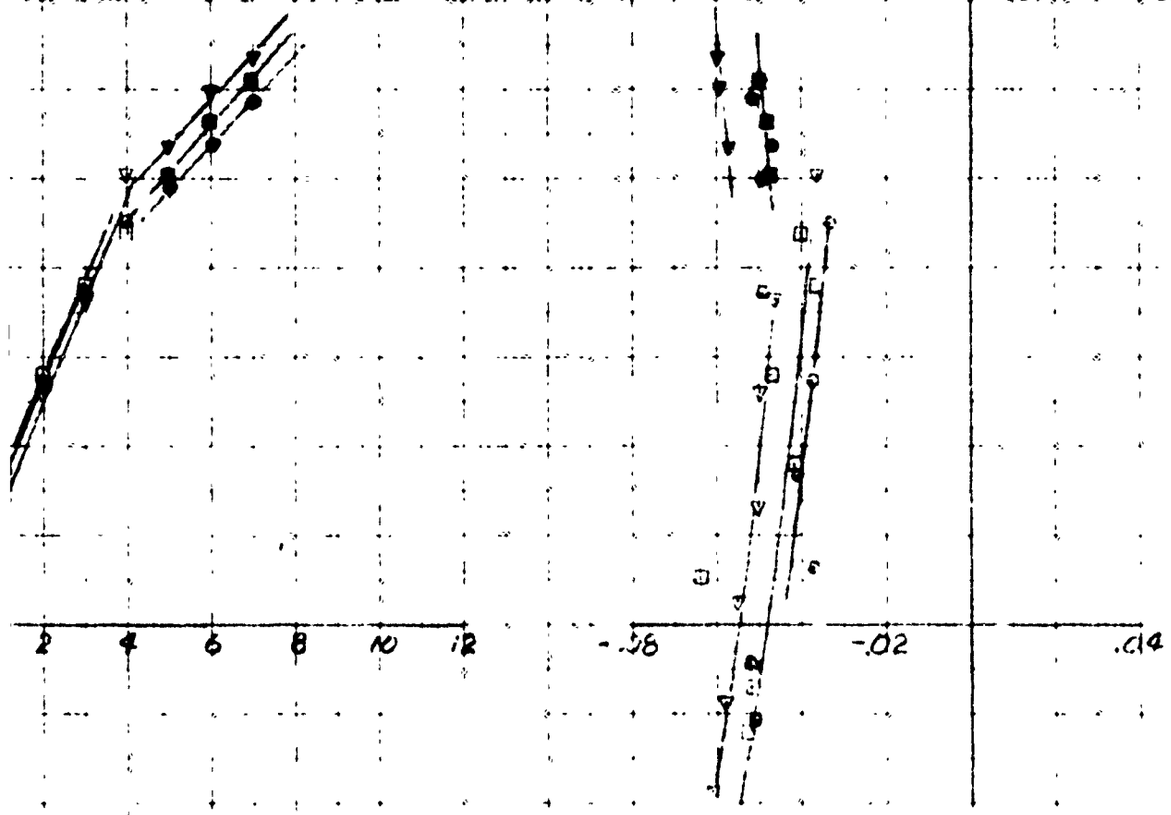
NOTE



WHIRLING TANK TEST NO 20M
NO 65 64454
MODEL NO. 3
40 KTS.
MAC. = .152 FT

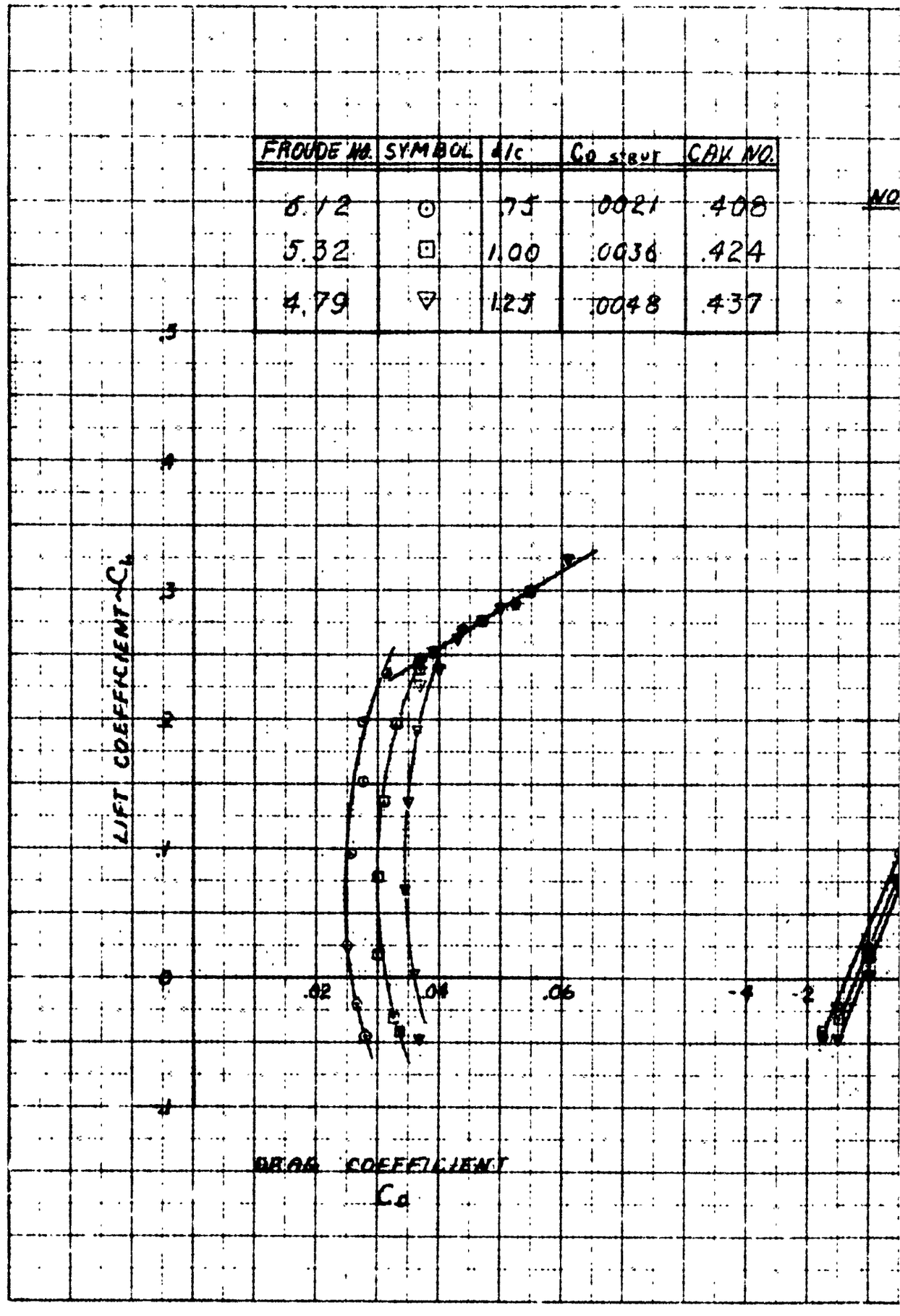
TE:

1. DARKENED SYMBOLS INDICATE VENTED FLOW.



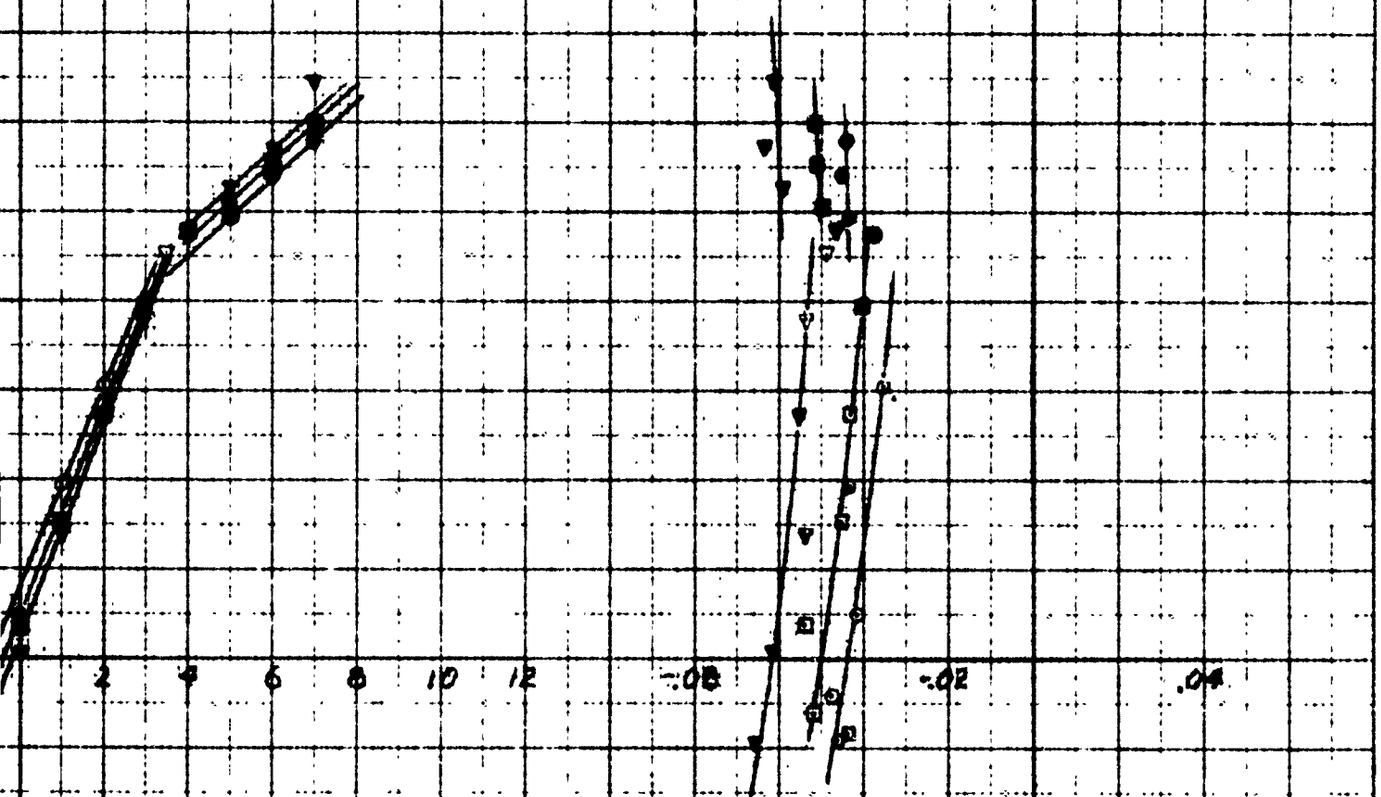
ANGLE OF ATTACK
α - DEGREES

PITCHING MOMENT
COEFFICIENT - $C_{M_{c/4}}$


FROUDE NO. | SYMBOL | d/c | Co STRUT | CAV. NO.
6.12 | ⊙ | .75 | .0021 | .408
5.32 | ⊡ | 1.00 | .0036 | .424
4.79 | ▽ | 1.25 | .0048 | .437
NO
LIFT COEFFICIENT ~ C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-4
-2
DRAG COEFFICIENT
C_D

WHIRLING TANK TEST NO. 20H
NO. 6s 84454
MODEL NO. 3
45 KTS.
M.A.C. = 15" ET

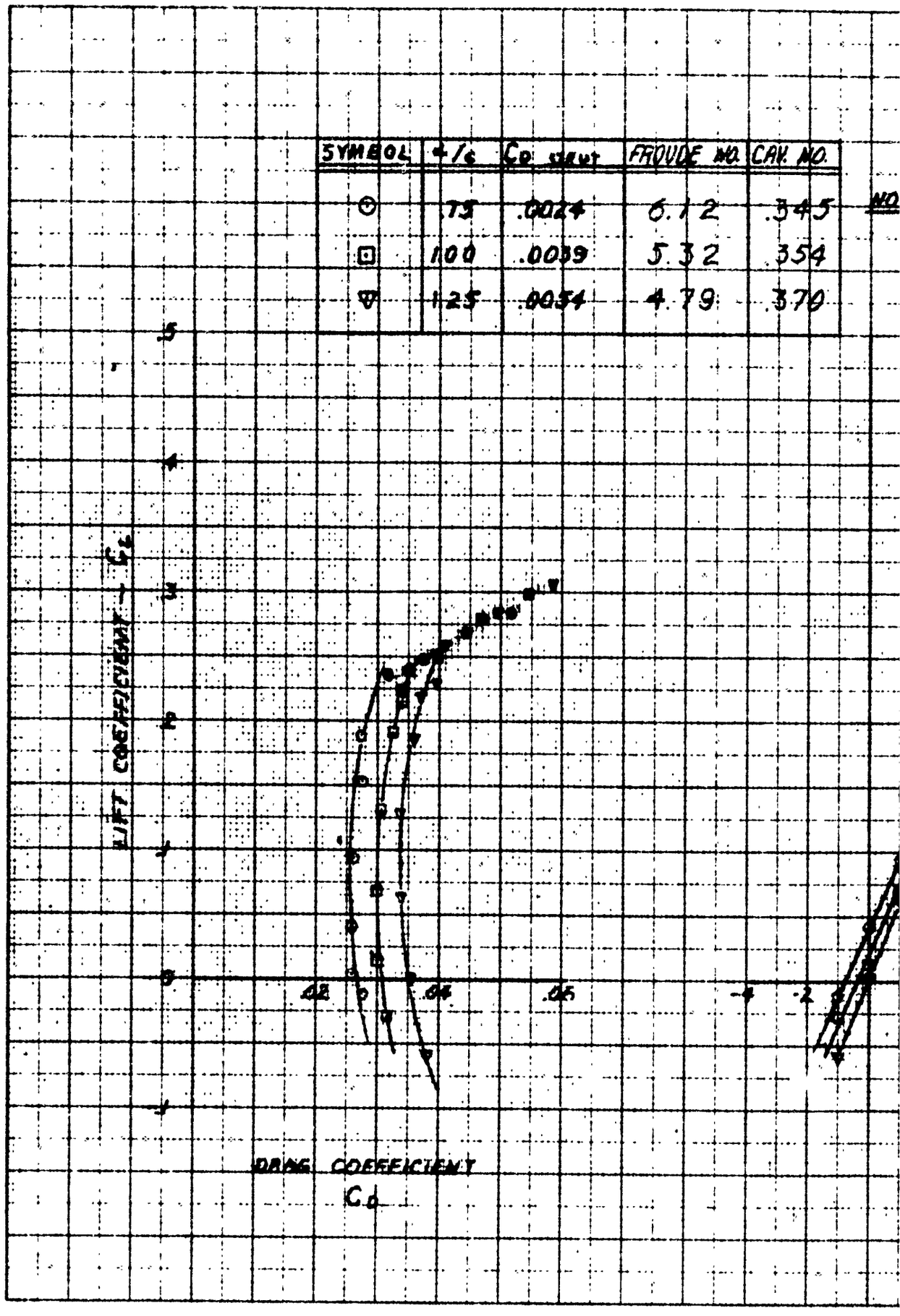
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



ANGLE OF ATTACK
α - DEGREES

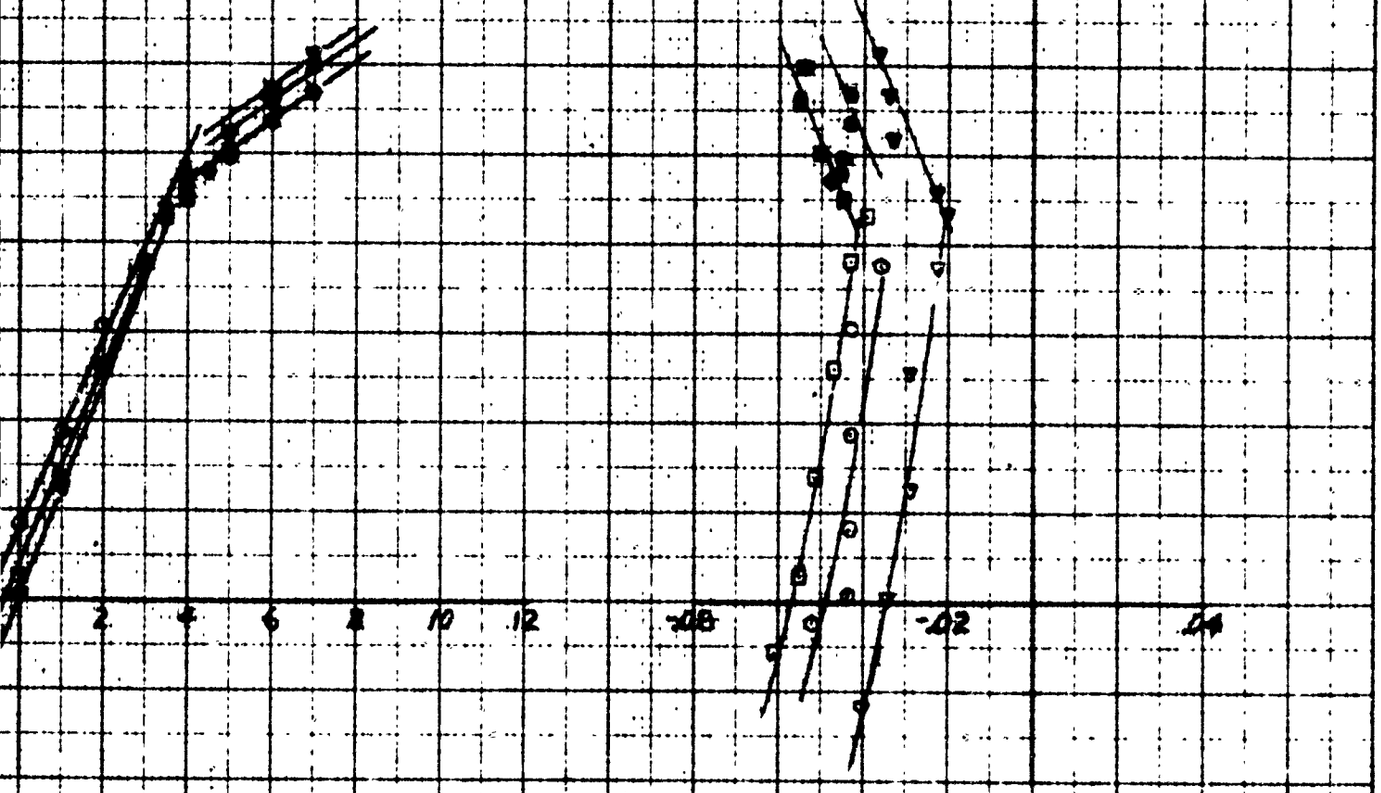
PITCHING MOMENT
COEFFICIENT - $C_{M_{C/4}}$

REPORT NO.


SYMBOL
FROUDE NO.
CAV. NO.
.75
.0024
6.12
.345
100
.0039
5.32
.354
125
.0054
4.79
.370
LIFT COEFFICIENT — C_L
DRAG COEFFICIENT
C_D
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-.4
-.2

WHIRLING TANK TEST NO. 20M
NO. 65 B4454
MODEL NO. 3
50 KTS.
MAC = 1.52 FT

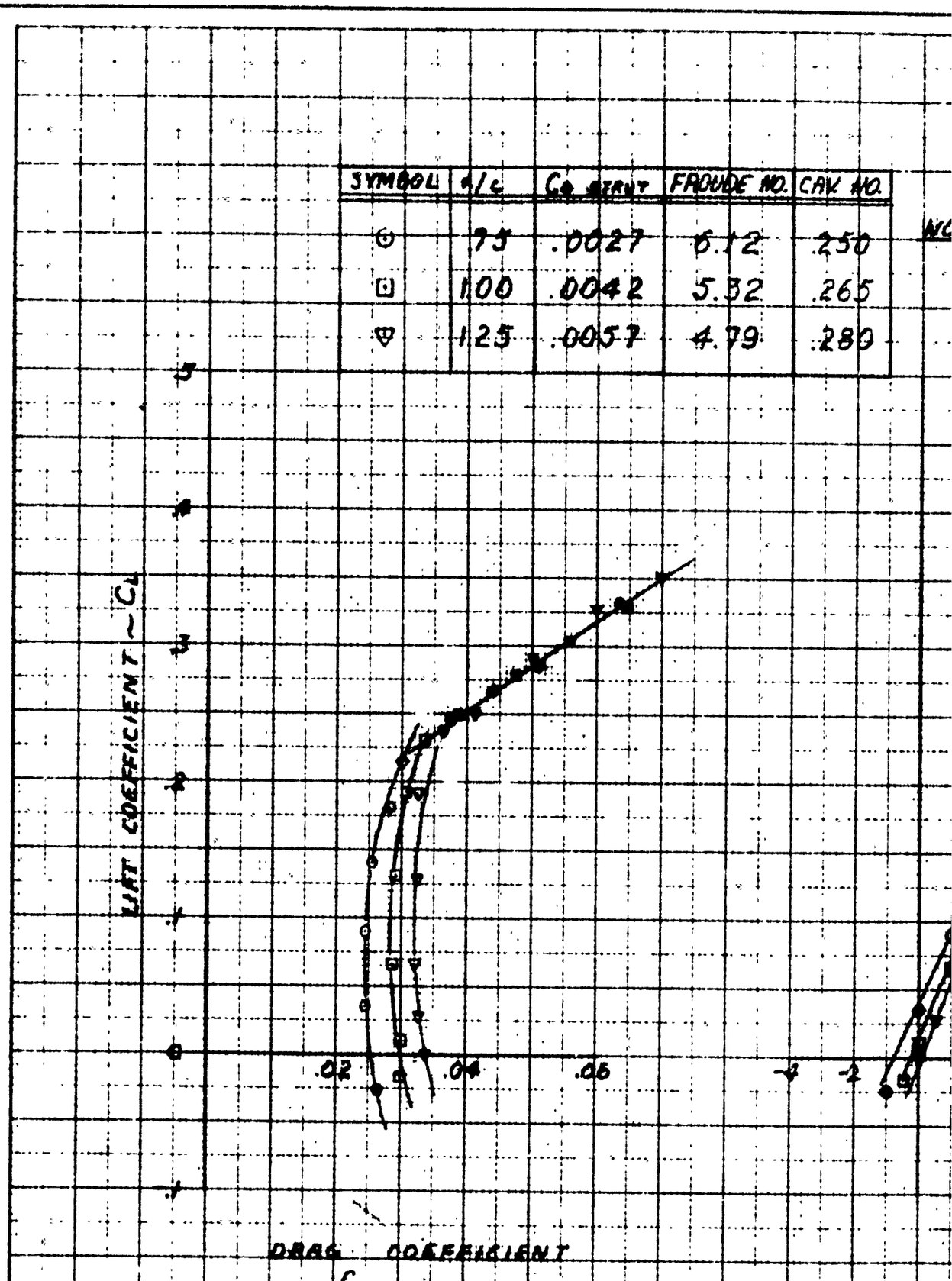
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



ANGLE OF ATTACK
α - DEGREES

PITCHING MOMENT
COEFFICIENT - $C_{M_{c/4}}$

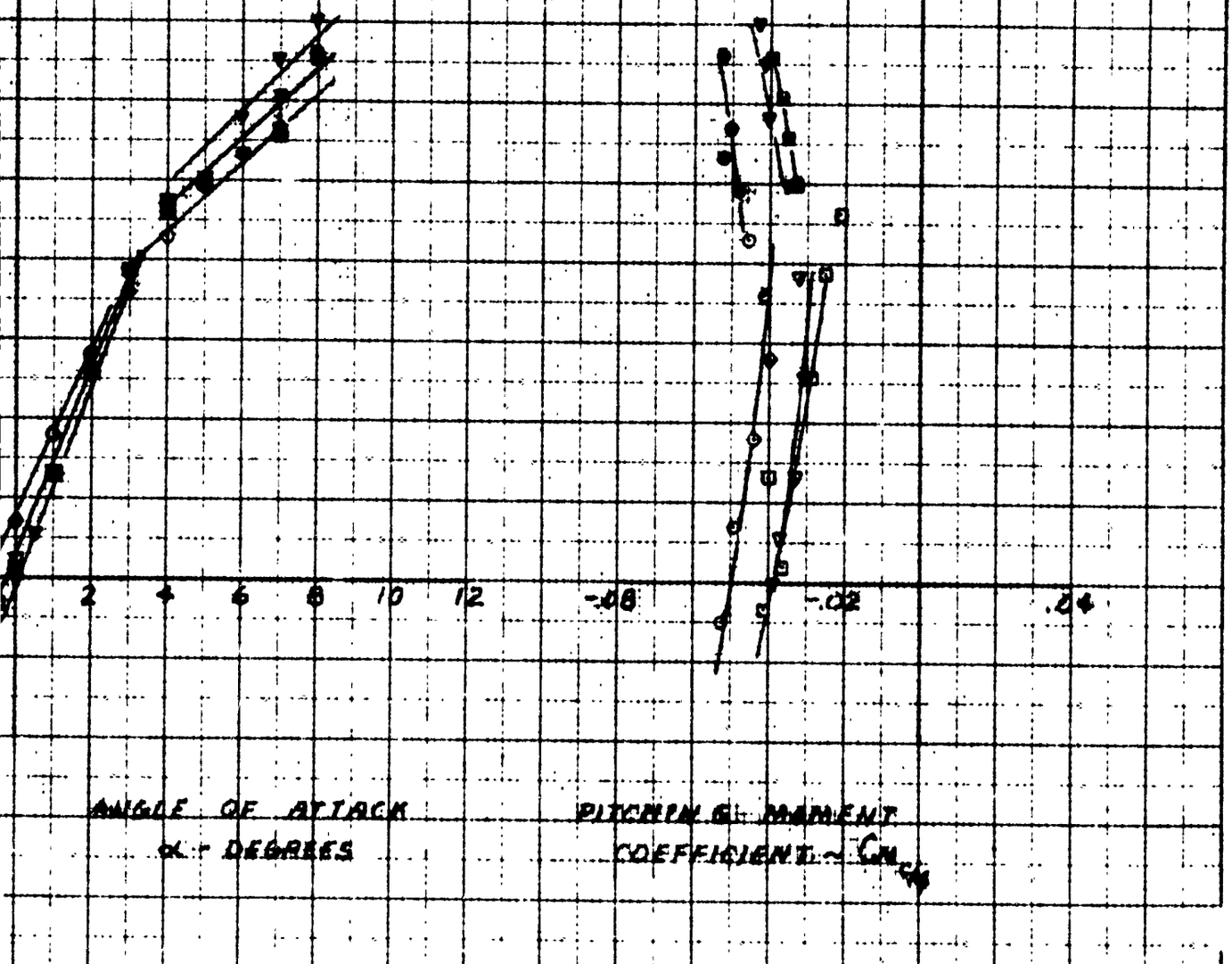
SYMBOL	d/c	$C_{d_{STRUT}}$	FROUDE NO.	CAV NO.
○	.75	.0027	6.12	.250
□	1.00	.0042	5.32	.265
▽	1.25	.0057	4.79	.280



K+E ALBANY NY 1967

WHIRLING TANK TEST NO 20H
NO. bS B4454
MODEL NO. 3
60 MTS.
M.A.C. = 152 Ft

NOTE:
DARKENED SYMBOLS INDICATE VENTED FLOW.

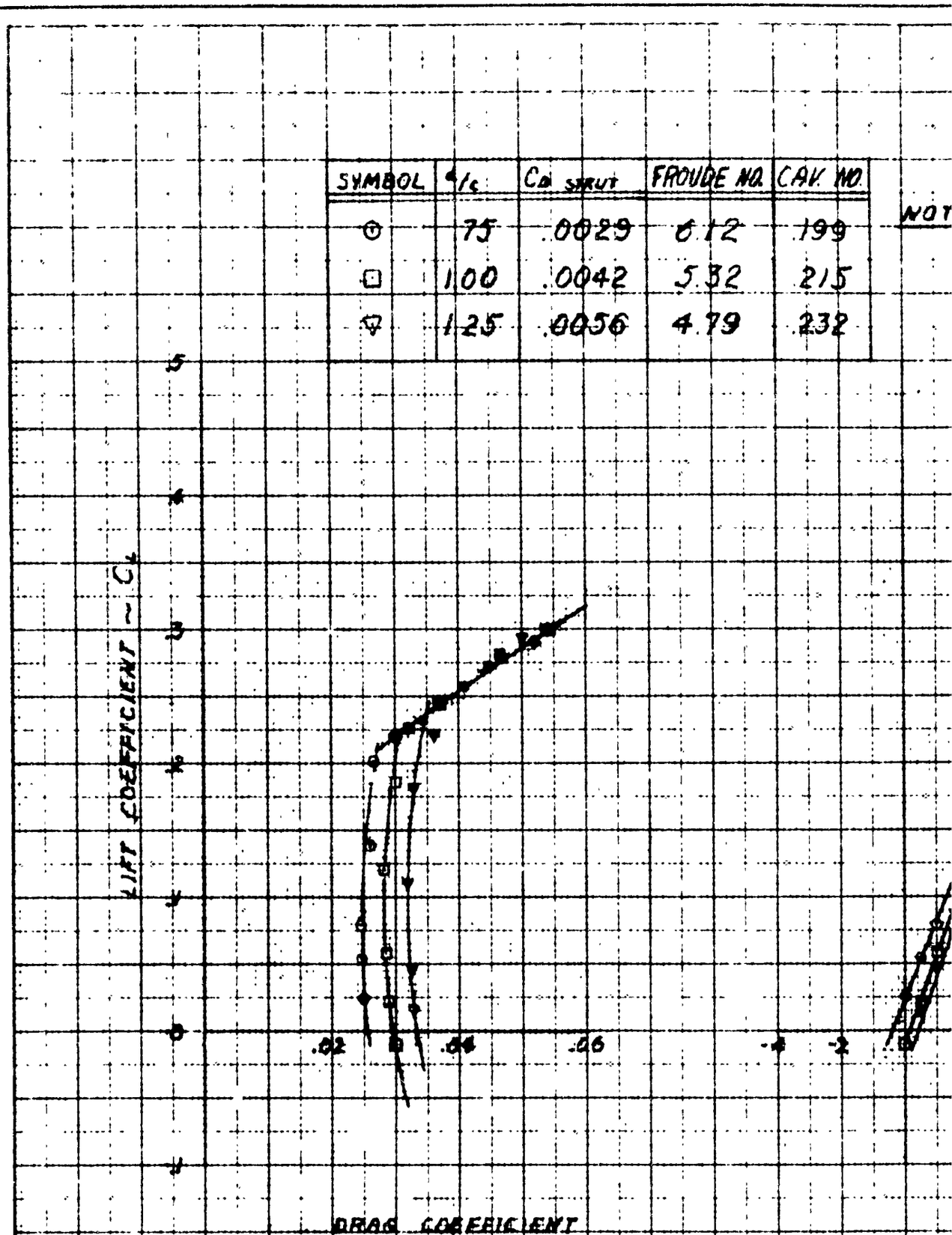


ANGLE OF ATTACK
α, DEGREES

PITCHING MOMENT
COEFFICIENT - C_M

SYMBOL	t/c	$C_{d\ STRUT}$	FROUDE NO.	CAV. NO
○	.75	.0029	6.12	.199
□	1.00	.0042	5.32	.215
▽	1.25	.0056	4.79	.232

NOT



K-E

WHIRLING TANK TEST NO. 20H

NO. DS B4434

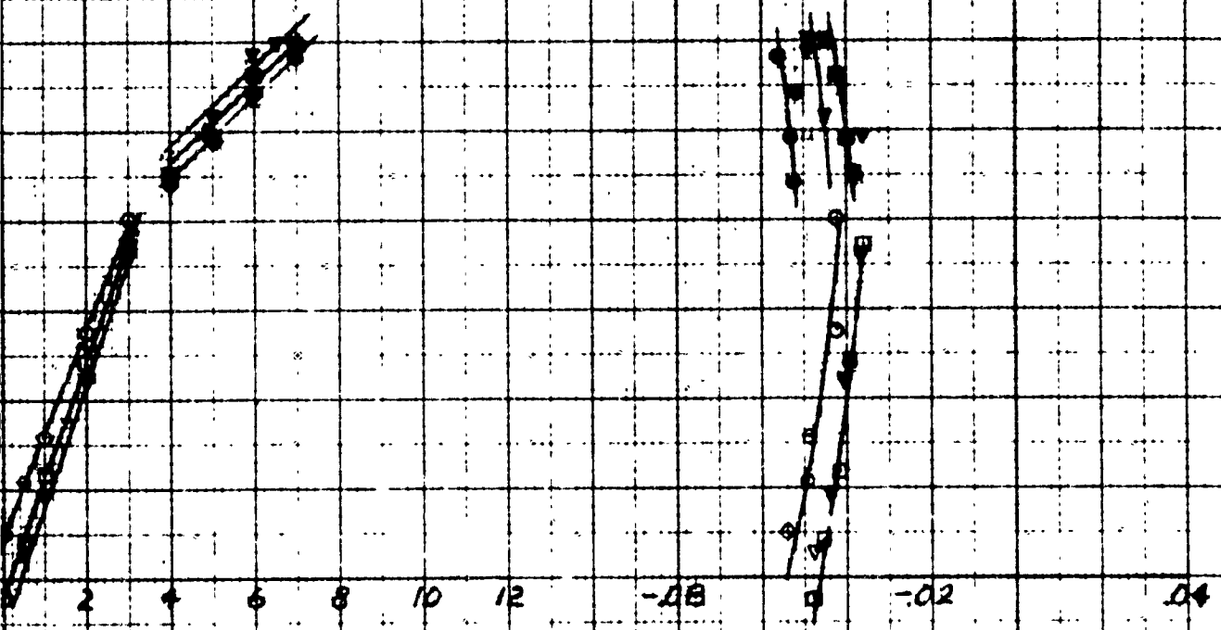
MODEL NO. 3

70 KTS.

M.A.C. = .152 Ft.

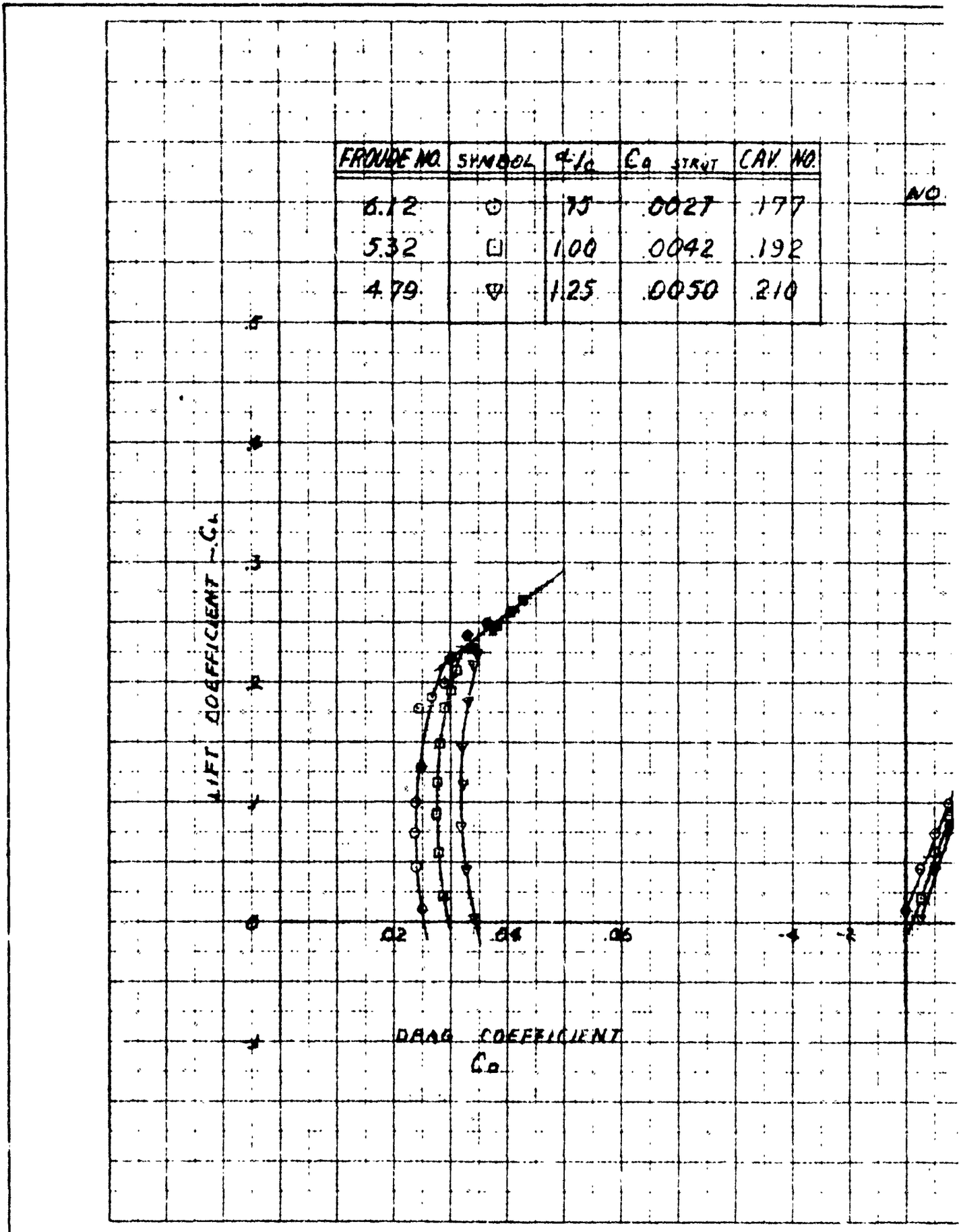
NOTE:

DARKENED SYMBOLS INDICATE VENTED FLOW



ANGLE OF ATTACK α + DEGREES

PITCHING MOMENT COEFFICIENT - $C_{M_{1/4}}$



GRUMMAN AIRCRAFT ENG

WHIRLING TANK TEST NO. 20H

NO. 65 84454

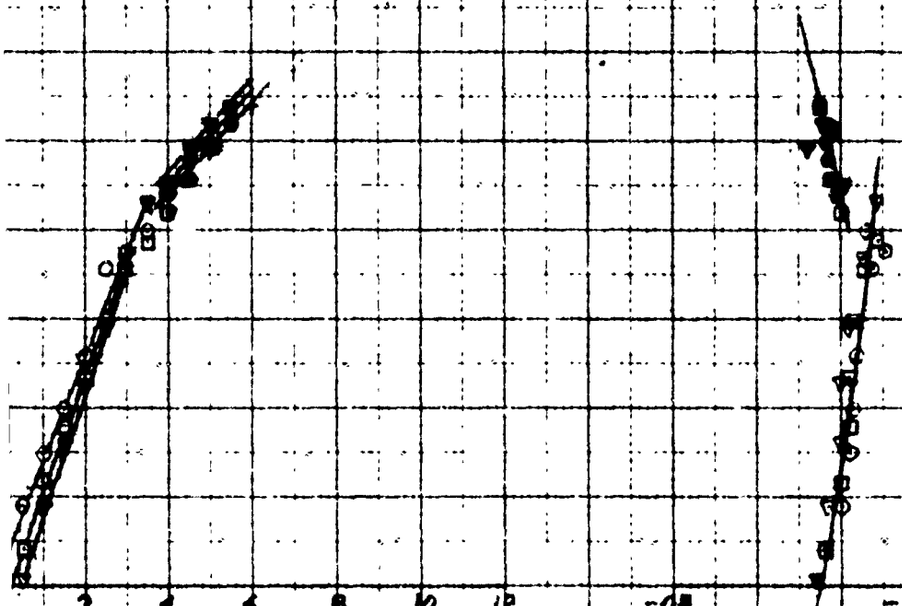
MODEL NO. 3

80 KTS.

M.A.C. = .152 FT

NOTE:

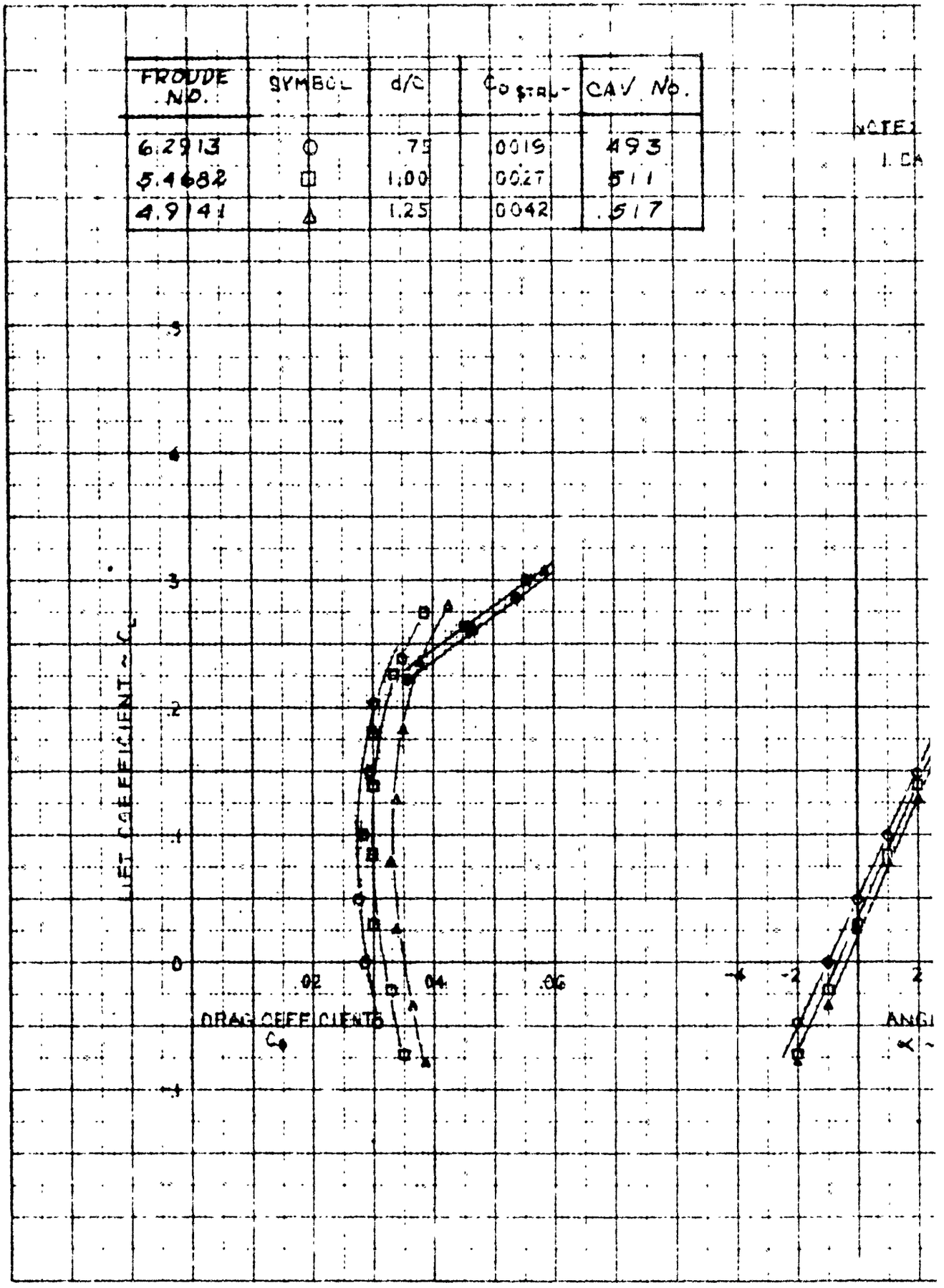
DARKENED SYMBOLS INDICATE VENTED FLOW.



ANGLE OF ATTACK
α - DEGREES

PITCHING MOMENT
COEFFICIENT = $C_{M_{c/4}}$

FROUDE NO.	SYMBOL	d/c	$C_{D_{STRUT}}$	CAV No.
6.2913	○	.75	0019	493
5.4682	□	1.00	0027	511
4.9141	△	1.25	0042	517

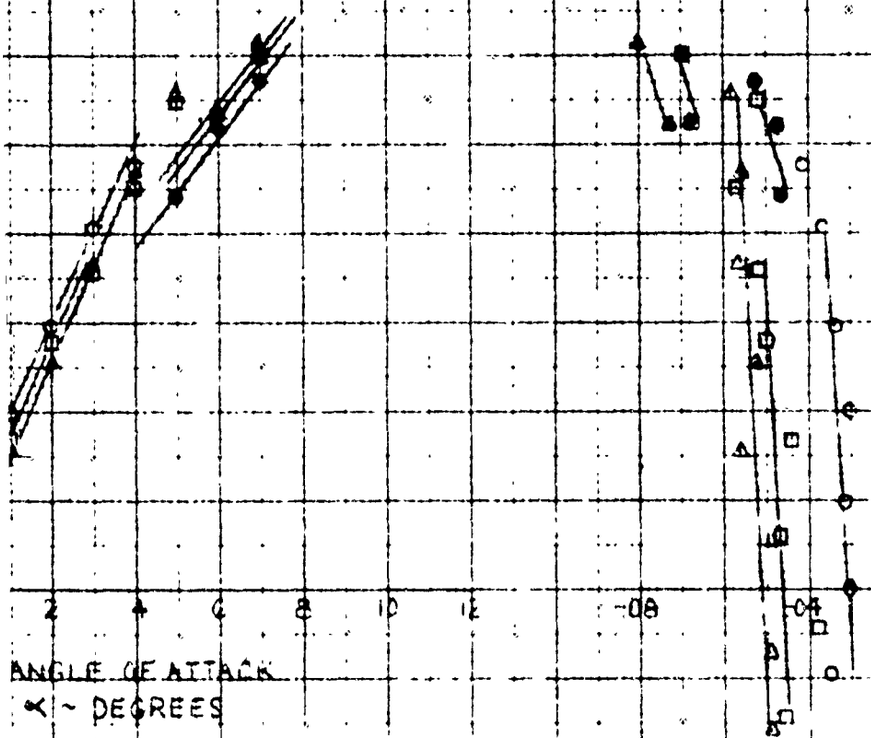


IE

1. DARKENED SYMBOLS INDICATE VENTED FLOW

WHIRLING TANK TEST NO 2-3G
BUSHIPS NO 4
40 KTS

MAC = 1.44 FT

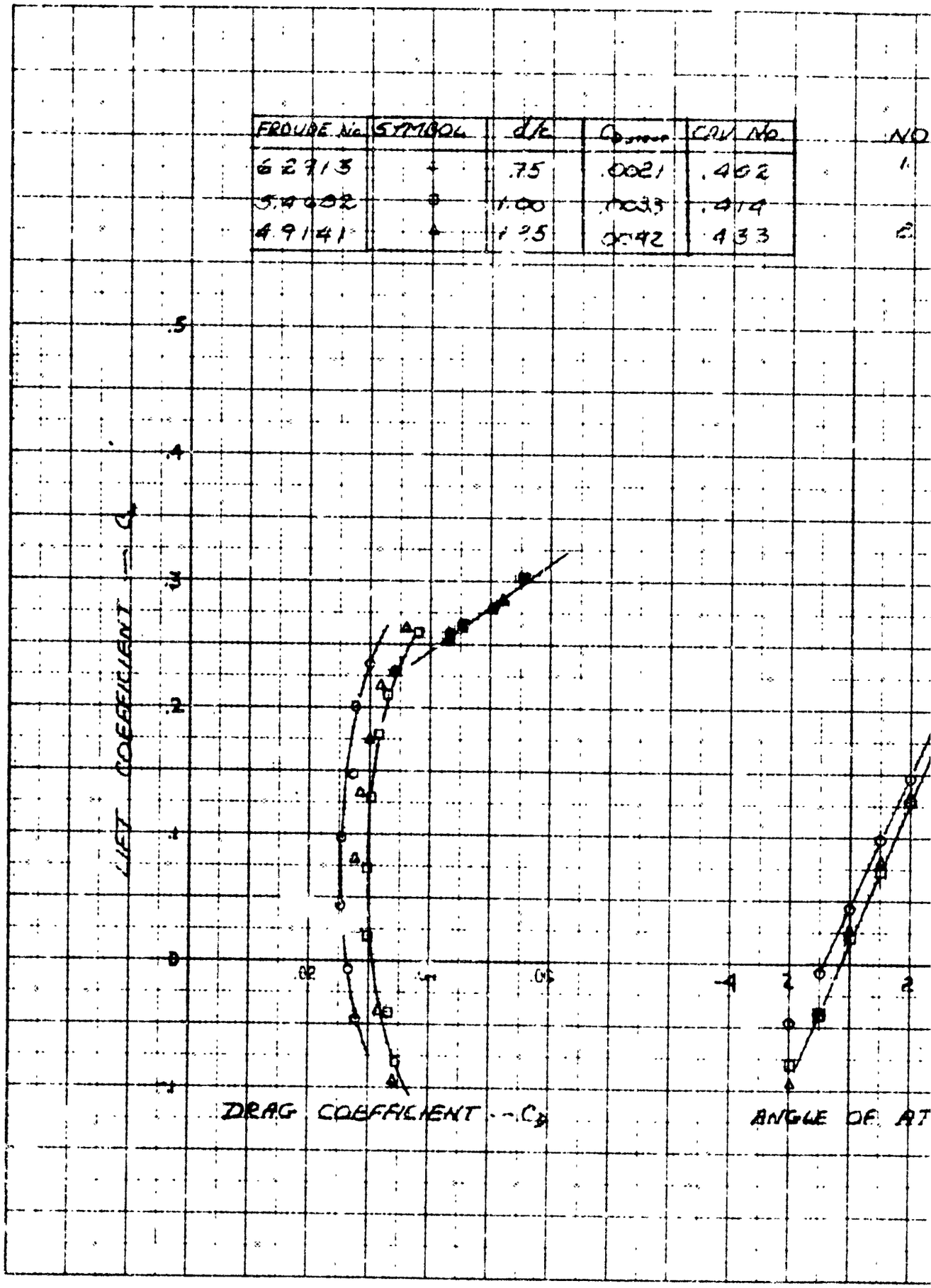


ANGLE OF ATTACK
α ~ DEGREES

PITCHING MOMENT
COEFFICIENT ~ $C_{M_{1/4}}$

FROUDE No.	SYMBOL	d/t	$C_{D_{min}}$	CAV No.
6.2713	+	.75	.0021	.402
5.4002	○	1.00	.0033	.414
4.9141	△	1.25	.0042	.433

NO



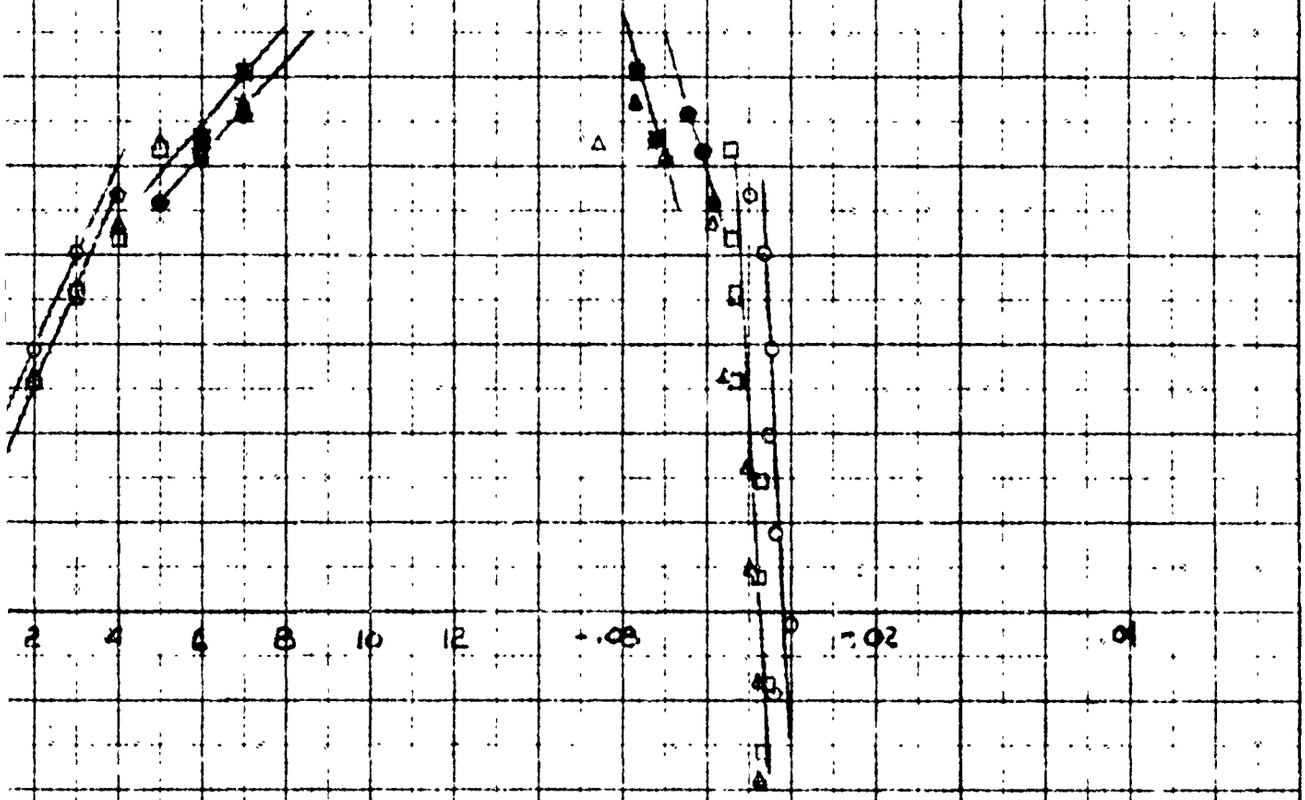
GRUMMAN AIRCRAFT ENGINE

NOTE

1. DARKENED SYMBOLS INDICATE VENTED FLOW

2. DATA @ $d/c = .125$ I.S. OPEN TO QUESTION

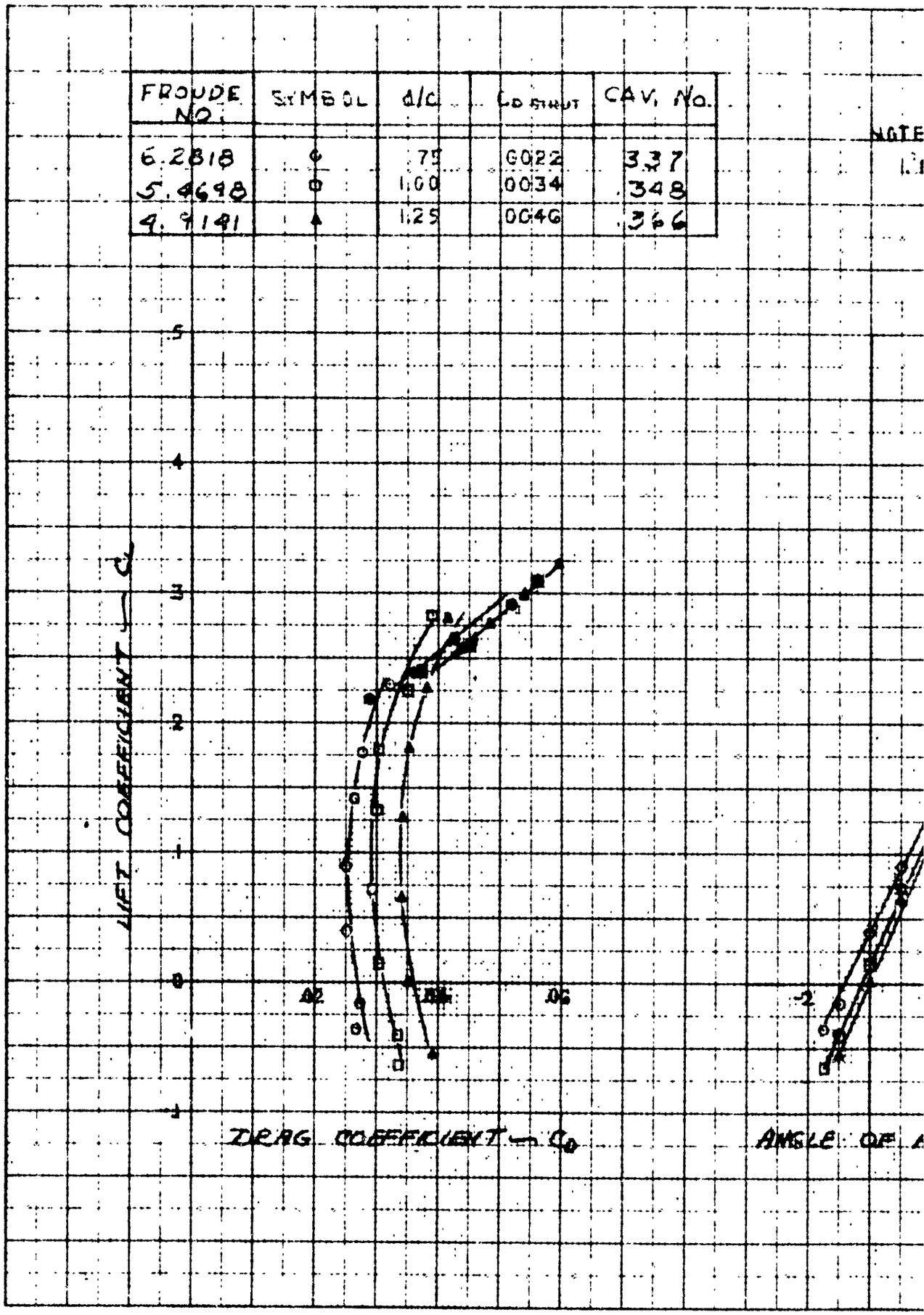
WHIRLING TANK TEST NO 206
BUSHIPS NO 4
45 KTS
M.A.C. = 1.44 FT.



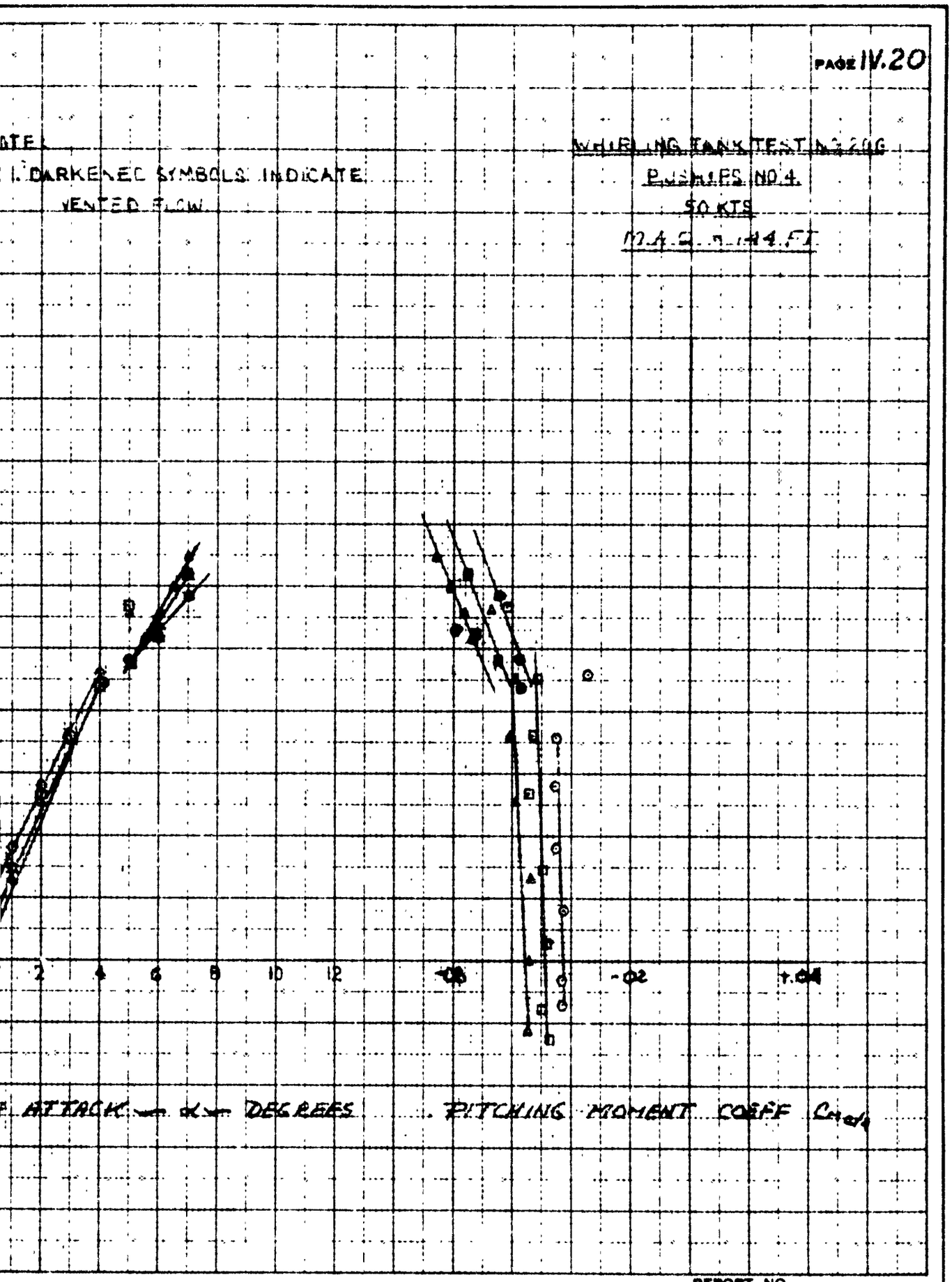
ATTACK — α — DEGREES

PITCHING MOMENT COEFF — $C_{M_{c/4}}$

FROUDE NO.	SYMBOL	d/c	C_D STRUT	CAV. NO.
6.2818	◇	.75	0022	.337
5.4698	○	1.00	0034	.348
4.9141	△	1.25	0046	.366

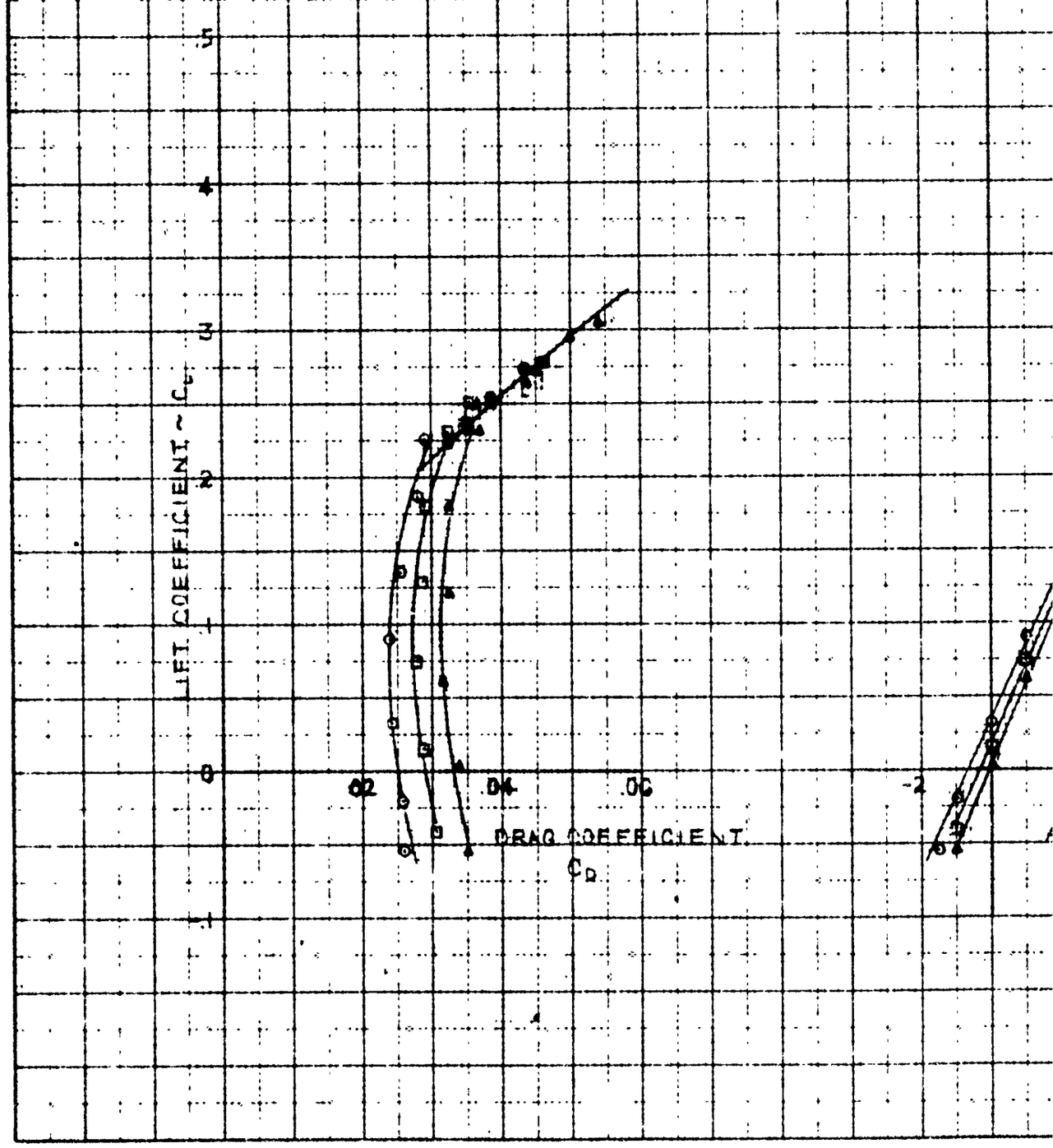


K+E ALBANENE 1967


ATE:
1. DARKENED SYMBOLS INDICATE
VENTED FLOW
WHIRLING TANK TEST NO 206
PUSHIPS NO 4.
50 KTS
M.A.C. = 144 FT
2
4
6
8
10
12
-.08
-.02
+.04
ATTACK — α — DEGREES
PITCHING MOMENT COEFF $C_{M_{\alpha/2}}$

FROUDE No	SYMBOL	d/c	$C_{D_{STRUT}}$	CAV. No.
6.2913	○	.75	.0025	.251
5.4682	□	1.00	.0039	.264
4.9141	▲	1.25	.0051	.279

NOTE
1. D

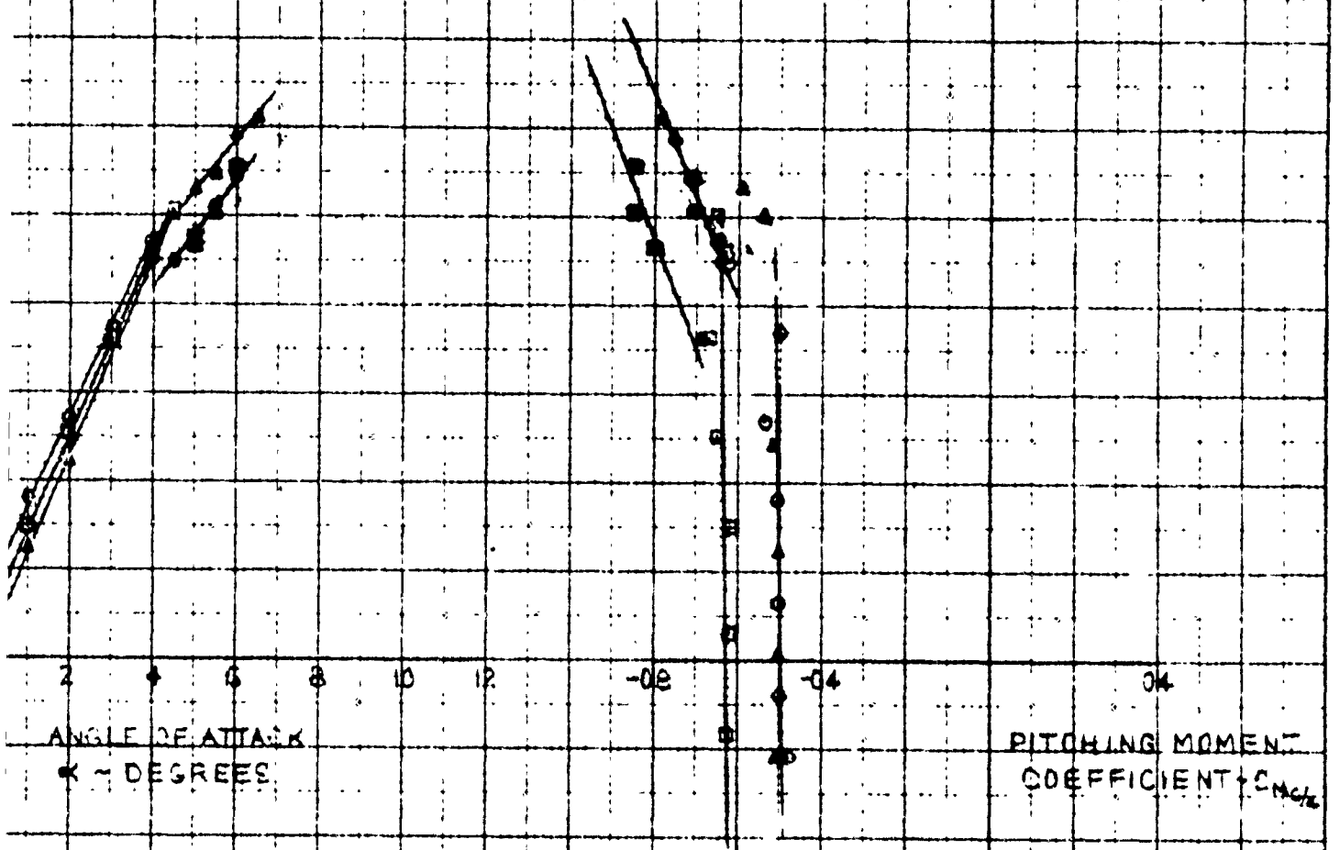


GRUMMAN AIRCRAFT EN

N-F ALBANENE 1967

NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW

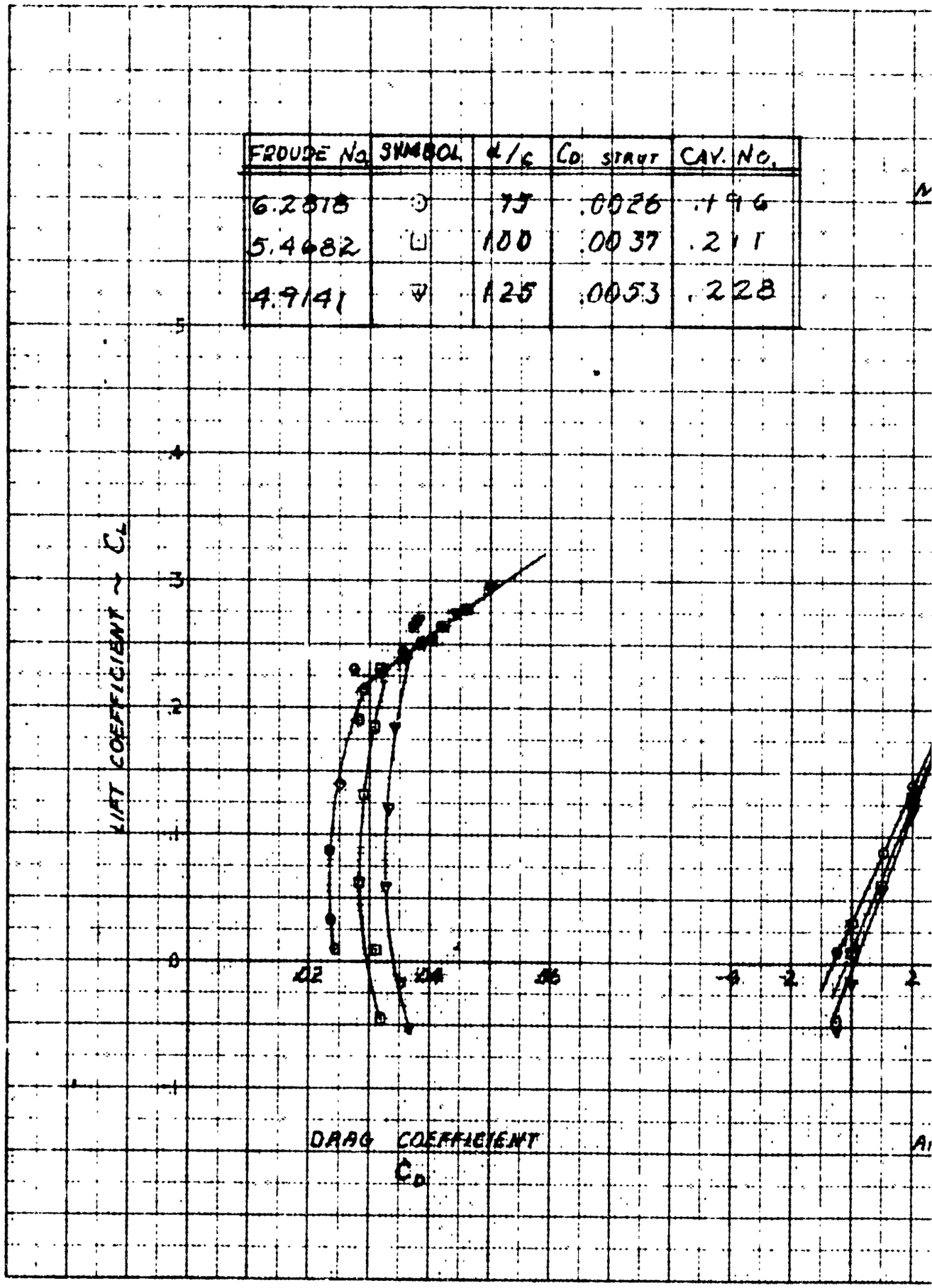
WHIRLING TANK TEST NO. 206
BUSHIPS NO. 4
60 K-S
M.A.C. ± .144 FT.



ANGLE OF ATTACK
α ~ DEGREES

PITCHING MOMENT
COEFFICIENT ± $C_{M_{c/4}}$

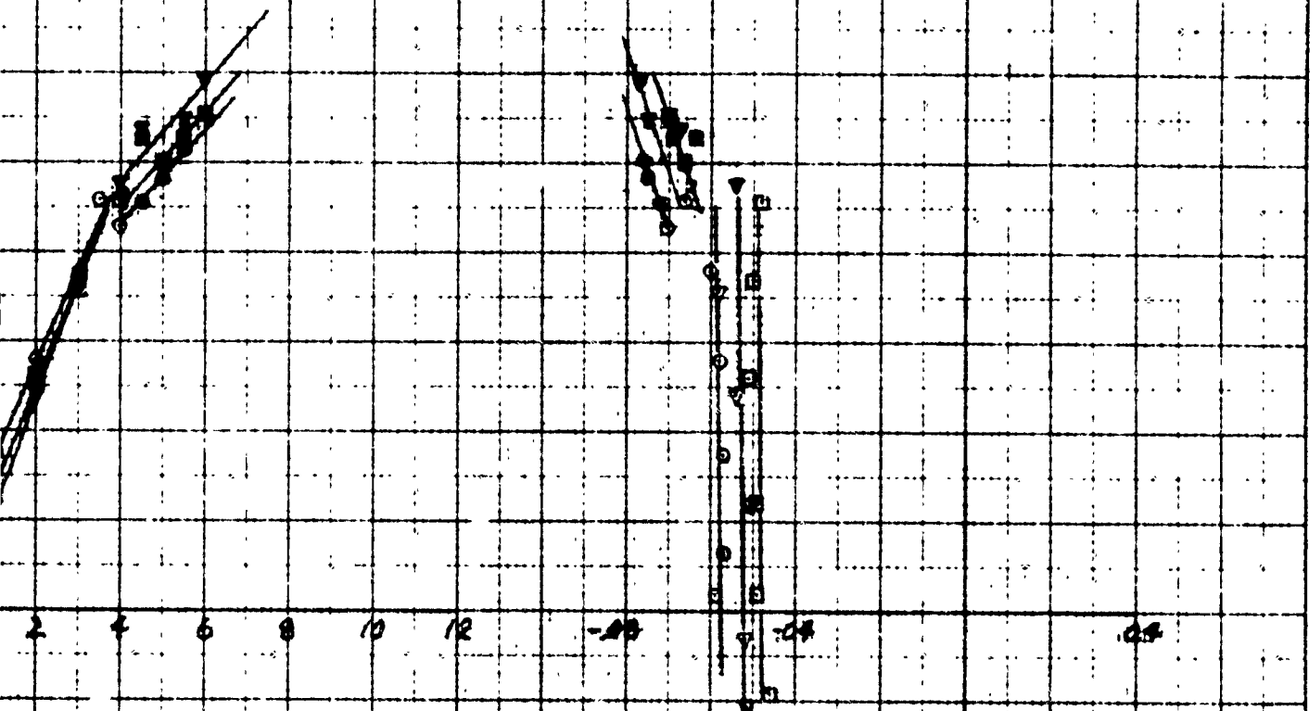
FROUDE No.	SYMBOL	d/c	C_D STRUT	CAV. No.
6.2818	○	75	.0026	.196
5.4682	□	100	.0037	.211
4.9141	▽	125	.0053	.228



K+E

WHIRLING TANK TEST NO. 206
60 SHIPS NO. 4
70 KTS.
M.A.C. = .144 FT.

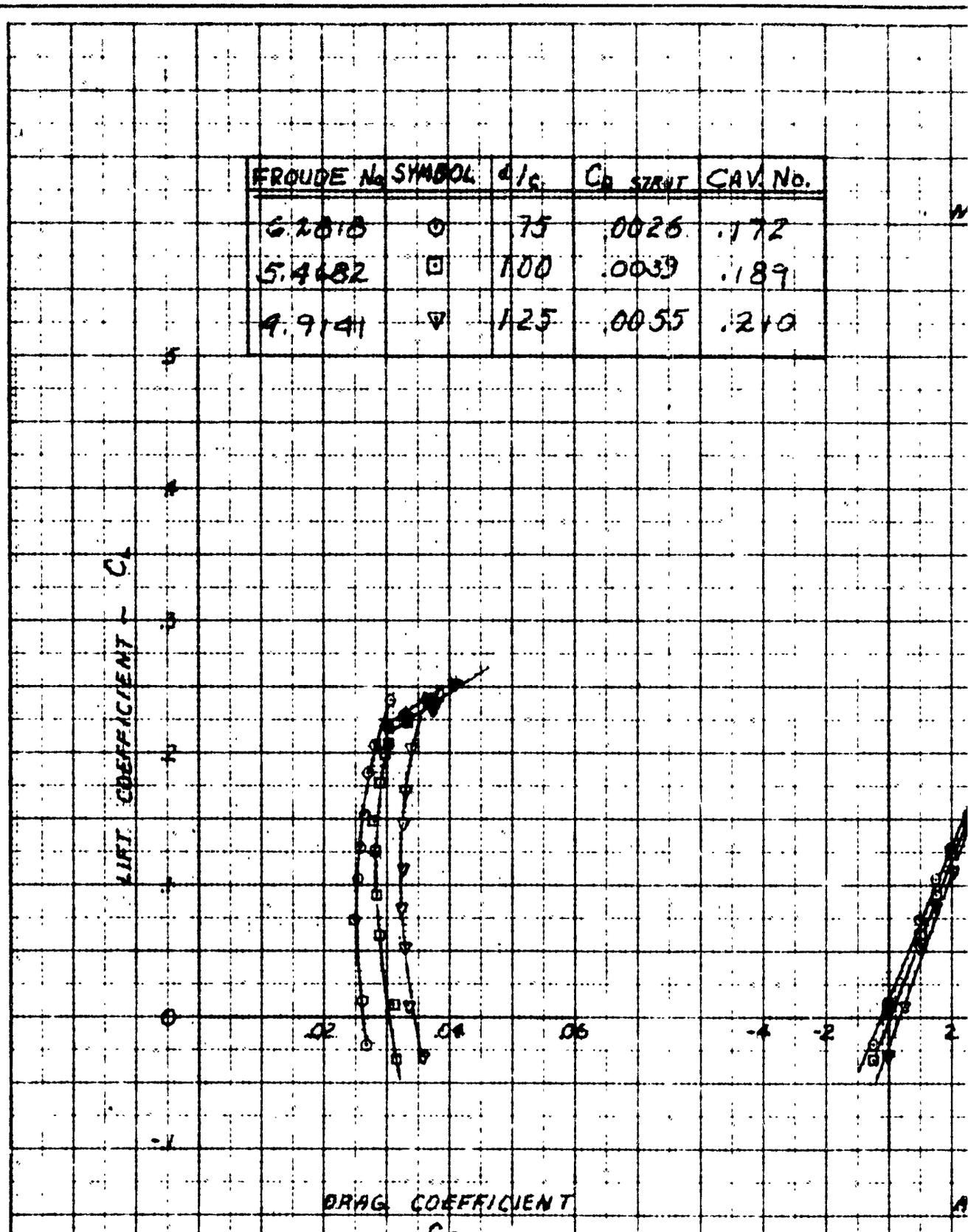
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



ANGLE OF ATTACK
α - DEGREES

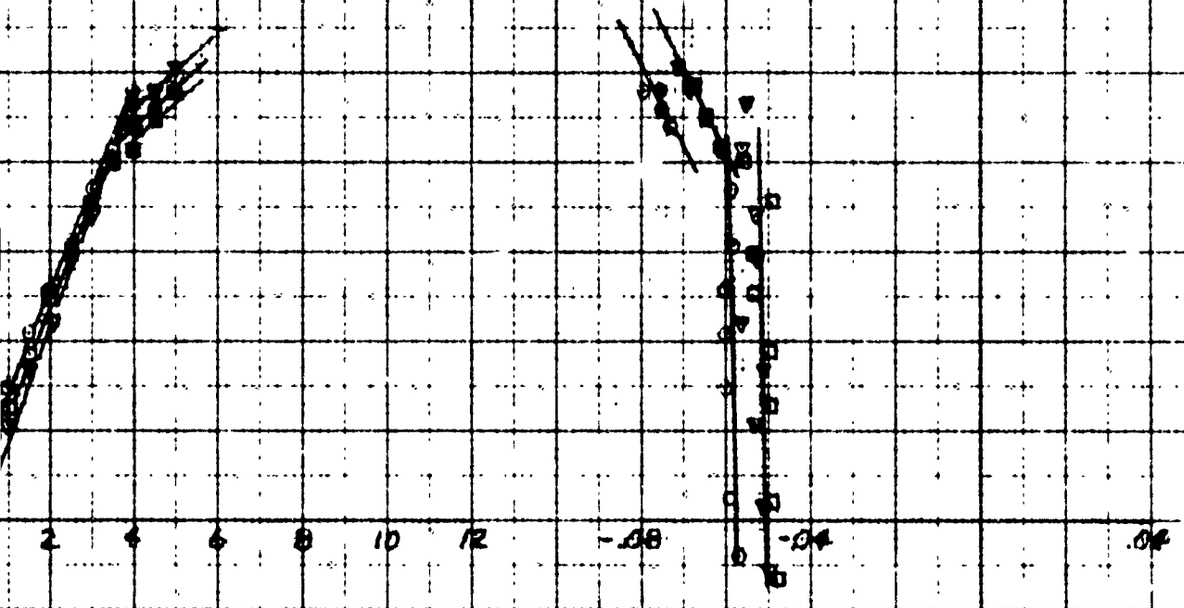
PITCHING MOMENT
COEFFICIENT - $C_{M_{c/4}}$

FROUDE No.	SYMBOL	d/c	C_D STRUT	CAV. No.
6.2818	⊙	.75	.0026	.172
5.4482	⊡	1.00	.0039	.189
4.9141	▽	1.25	.0055	.240



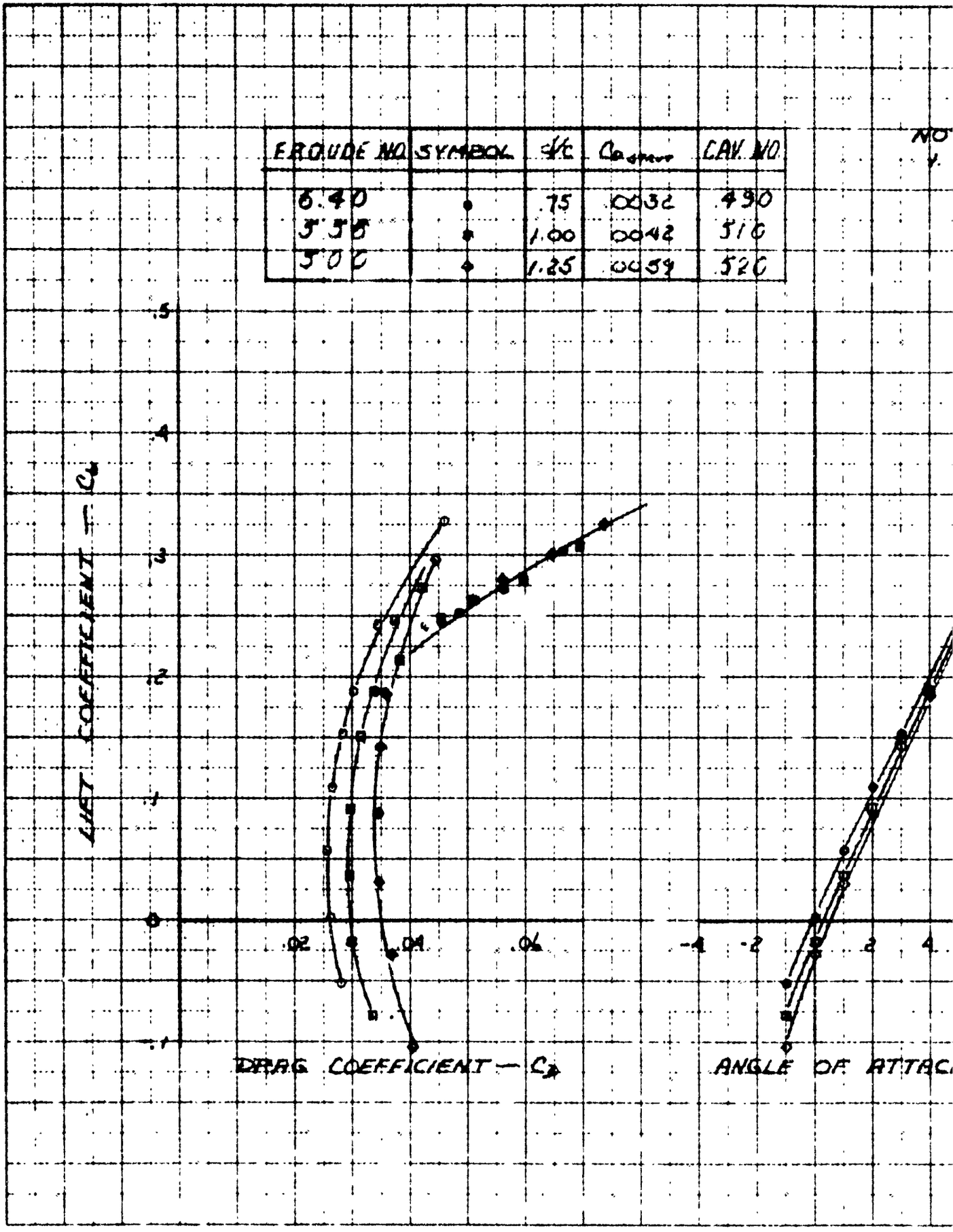
WHIRLING TANK TEST NO. 20G
BU SHIPS NO. 4
80 KTS
MAC = .144 FT

NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



ANGLE OF ATTACK
α - ATTACH

PITCHING MOMENT
COEFFICIENT - $C_{M_{C/4}}$



FROUDE NO.
SYMBOL
d/c
$C_{D_{strut}}$
CAV. NO.
6.40
.75
.0032
.490
5.56
1.00
.0042
.510
5.00
1.25
.0059
.520
LIFT COEFFICIENT — C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-4
-2
2
4
DRAG COEFFICIENT — C_D
ANGLE OF ATTAC

WHIRLING TANK TEST NO 202

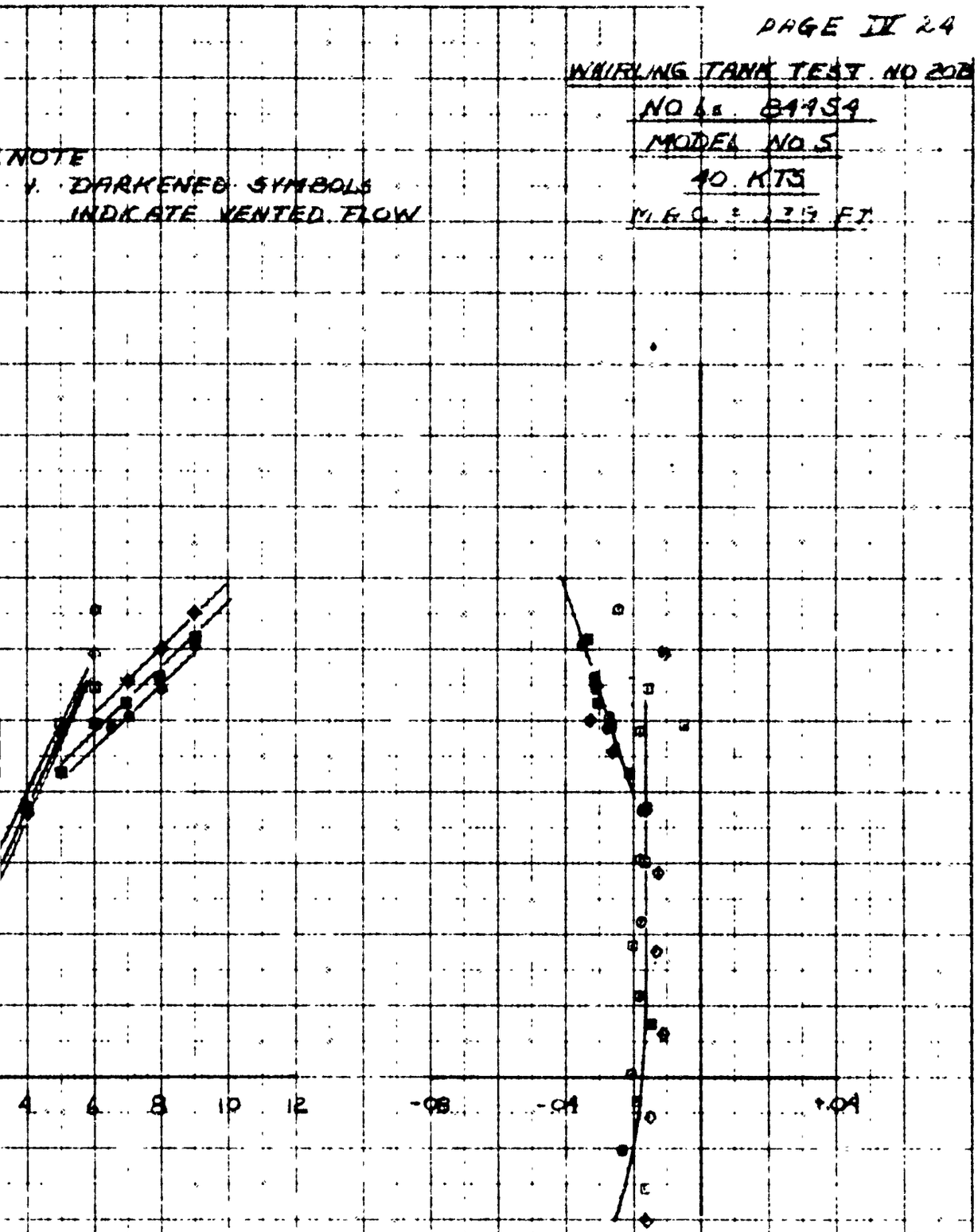
NO Lb. 84954

MODEL NO 5

40 KTS

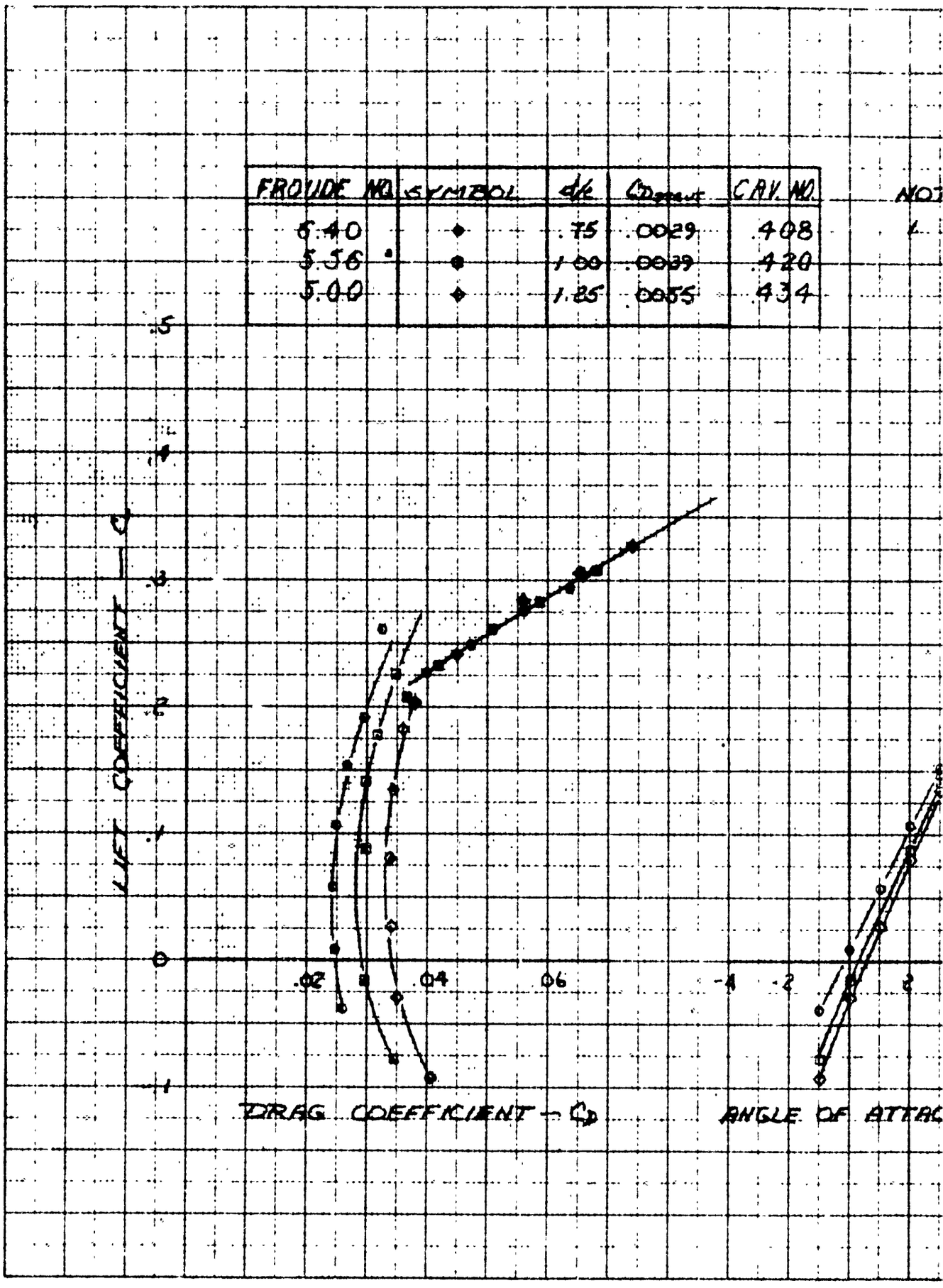
M.A.C. = 1.715 FT.

NOTE
V. DARKENED SYMBOLS INDICATE VENTED FLOW



ATTACK — α — DEGREES

PITCHING MOMENT COEFFICIENT — $C_{m_{c/4}}$


FROUDE NO.
SYMBOL
d/c
CAV. NO.
6.40
.75
.0029
.408
5.56
1.00
.0039
.420
5.00
1.25
.0055
.434
NOT
LIFT COEFFICIENT — C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-.4
-.2
.2
DRAG COEFFICIENT — C_D
ANGLE OF ATTAC

WHIRLING TANK TEST NO. 208

NO Cs 84454

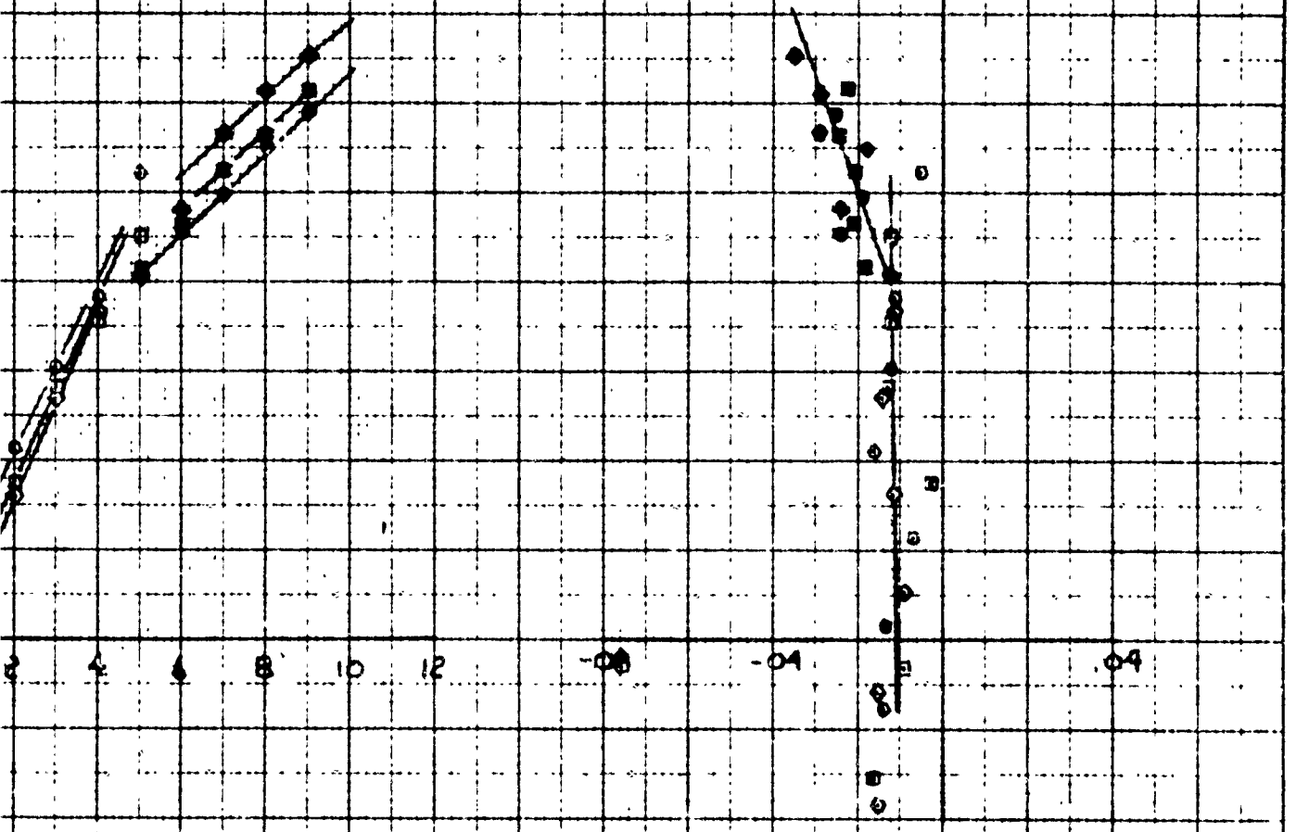
MODEL NO 5

45 KTS

M.A.C. = 137 FT

NOTE:

1. DARKENED SYMBOLS INDICATE VENTED FLOW

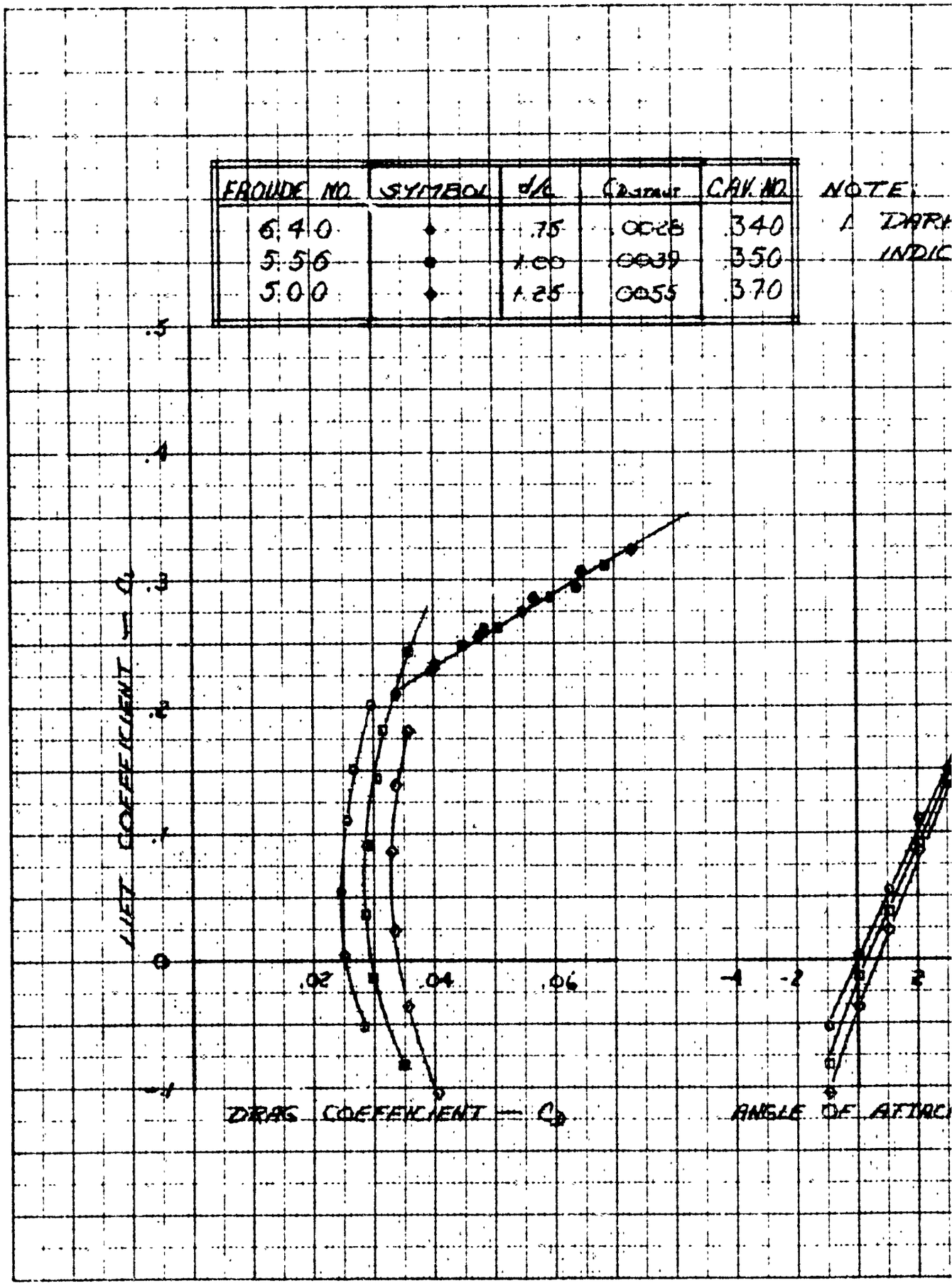


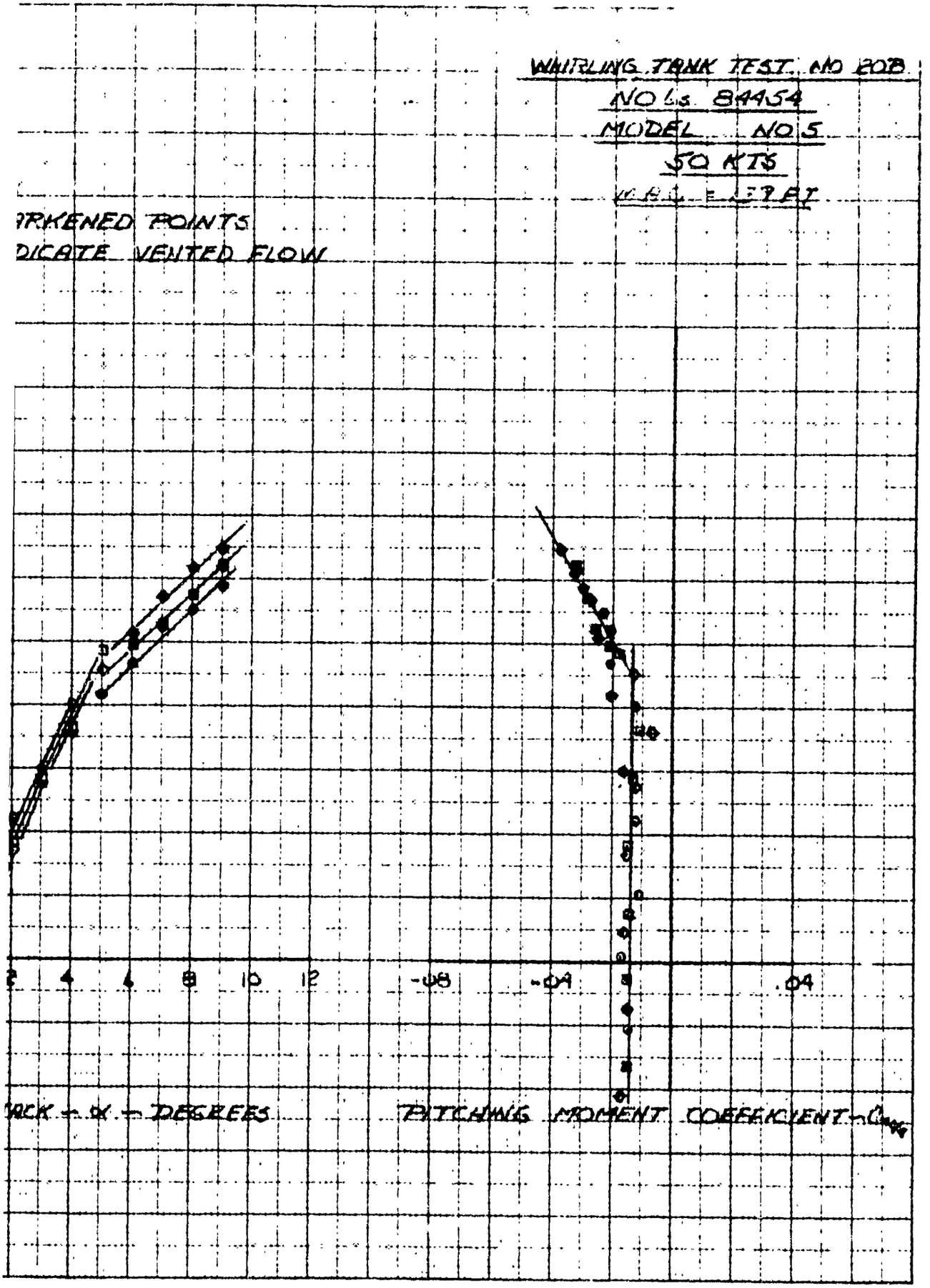
TACK — α — DEGREES

PITCHING MOMENT COEFFICIENT — $C_{m_{c/4}}$

FROUDE NO.	SYMBOL	d/L	Cavitator	CAV. NO.
6.40	◆	.75	0028	.340
5.56	●	1.00	0039	.350
5.00	◆	1.25	0055	.370

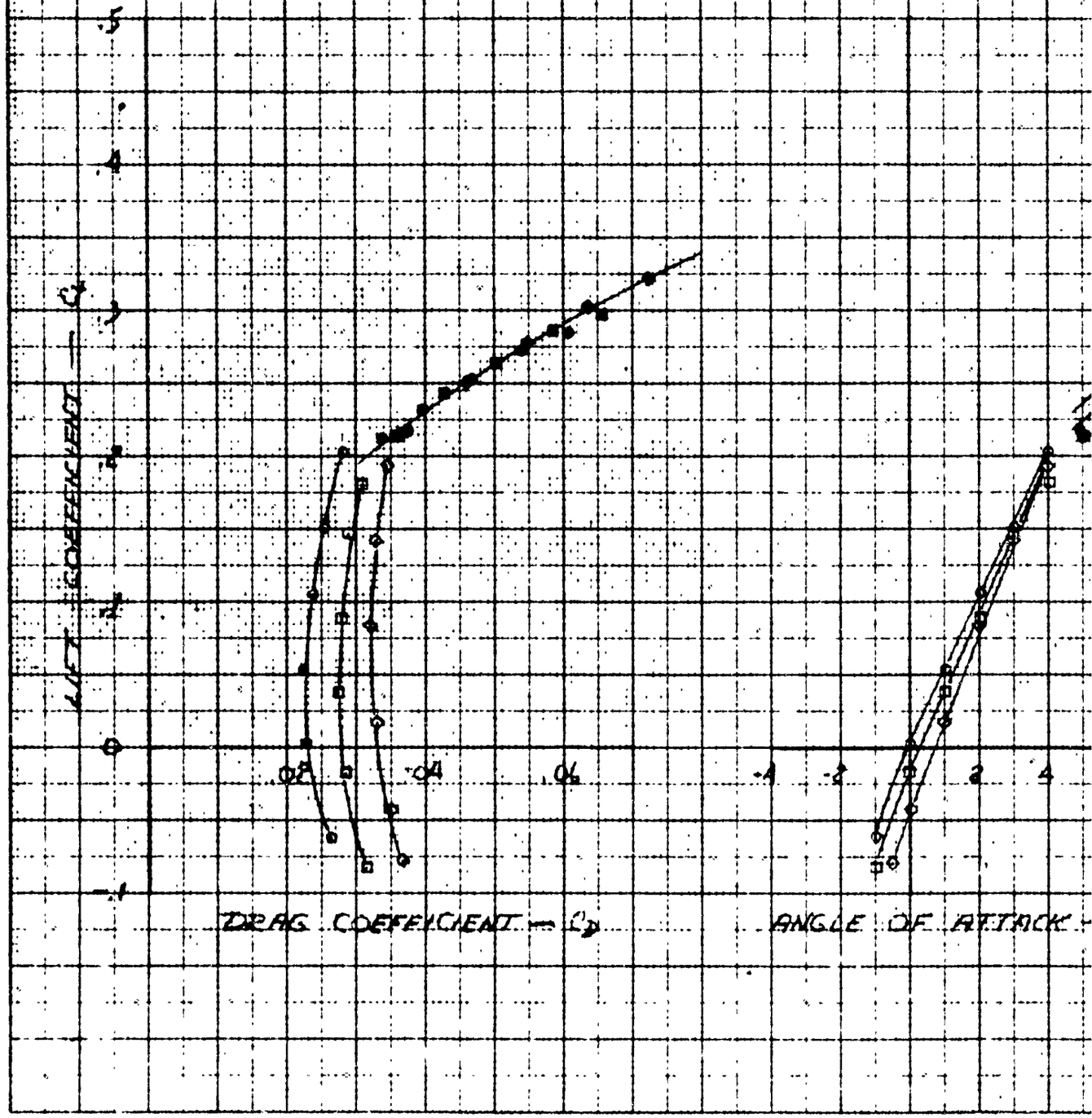
NOTE:
A DARK
INDIC




WHIRLING TANK TEST NO 20B
NO Ls 84454
MODEL NO 5
50 KTS
RKENED POINTS
DICATE VENTED FLOW
2
4
6
8
10
12
-.08
-.04
.04
ACK - α - DEGREES
PITCHING MOMENT COEFFICIENT - $C_{m_{\alpha_0}}$

FROUDE NO.	SYMBOL	d/L	Cb area	CAV. NO.
6.40	♦	.75	.0029	250
5.56	●	1.00	.0039	260
5.00	✦	1.25	.0055	275

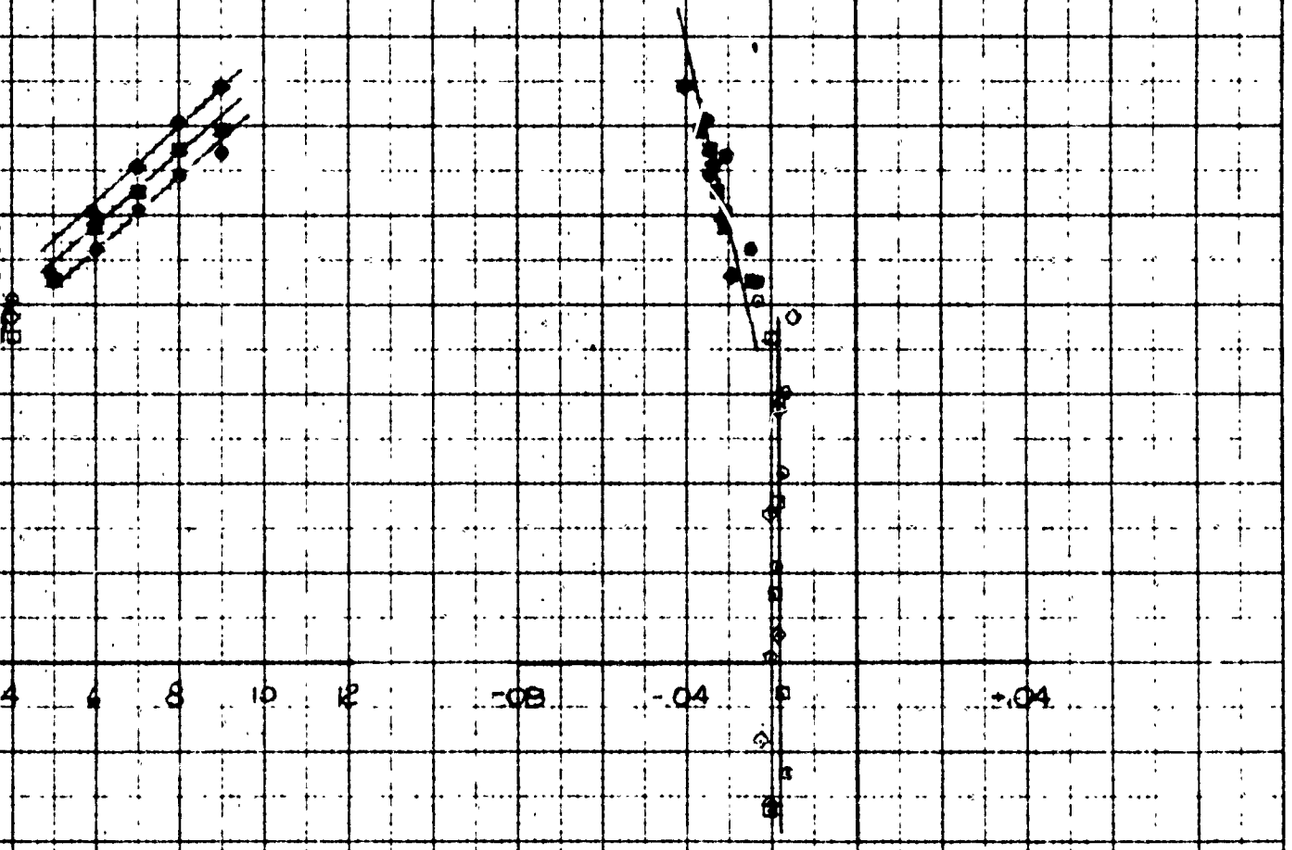
NOTE:
1. DARKEN
INDICAT



K+E

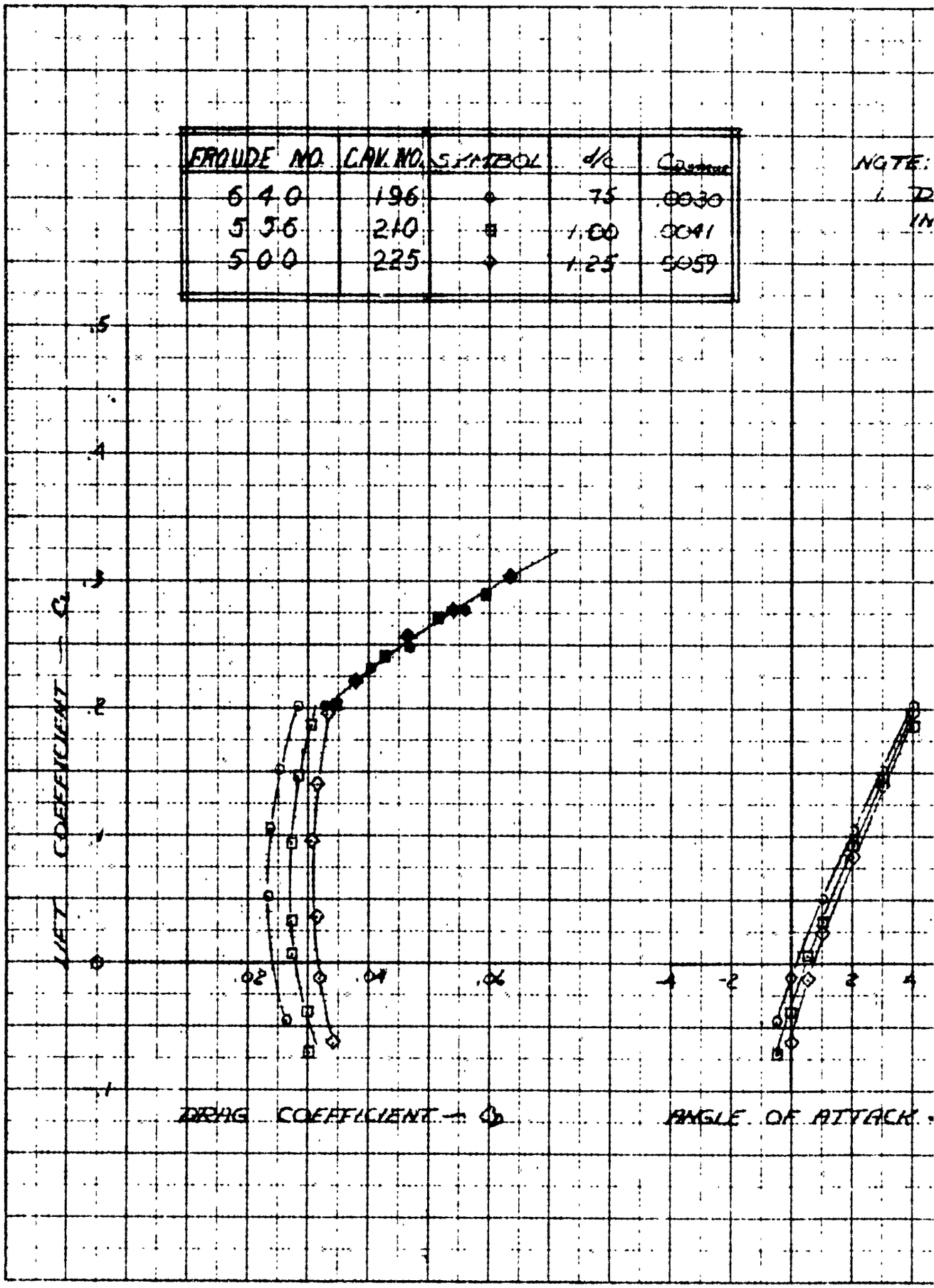
WHIRLING TANK TEST NO. 20B.
NO. 84454
MODEL NO 5
60 KTS
M.A.C. = 1.37 FT.

KEWED SYMBOLS
EATE VENTED FLOW

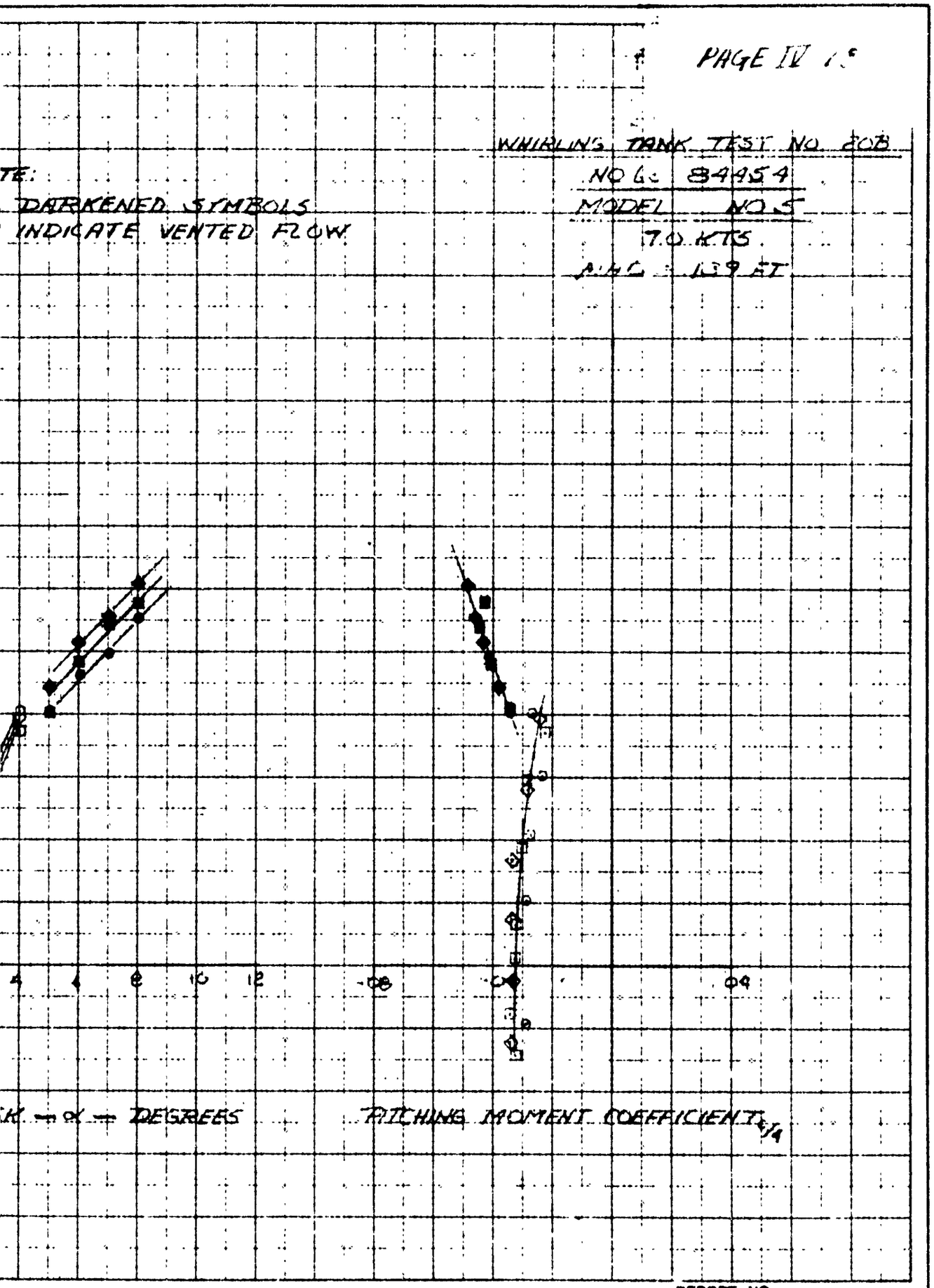


4 4 8 10 12 -.08 -.04 0 +.04

K — α — DEGREES PITCHING MOMENT COEFFICIENT — $C_{M_{C/4}}$



K+E ALBANENE 1087

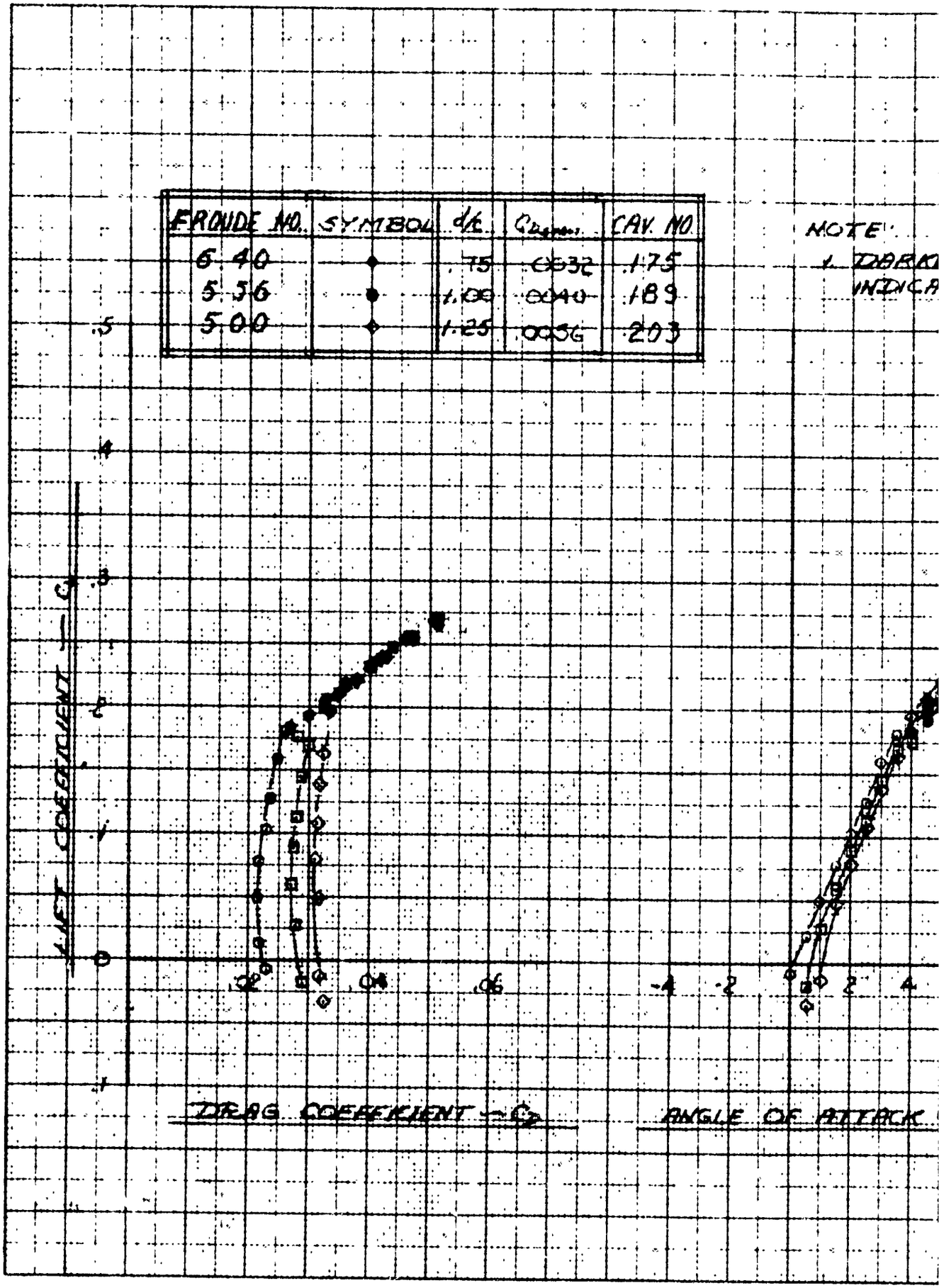


REPORT NO

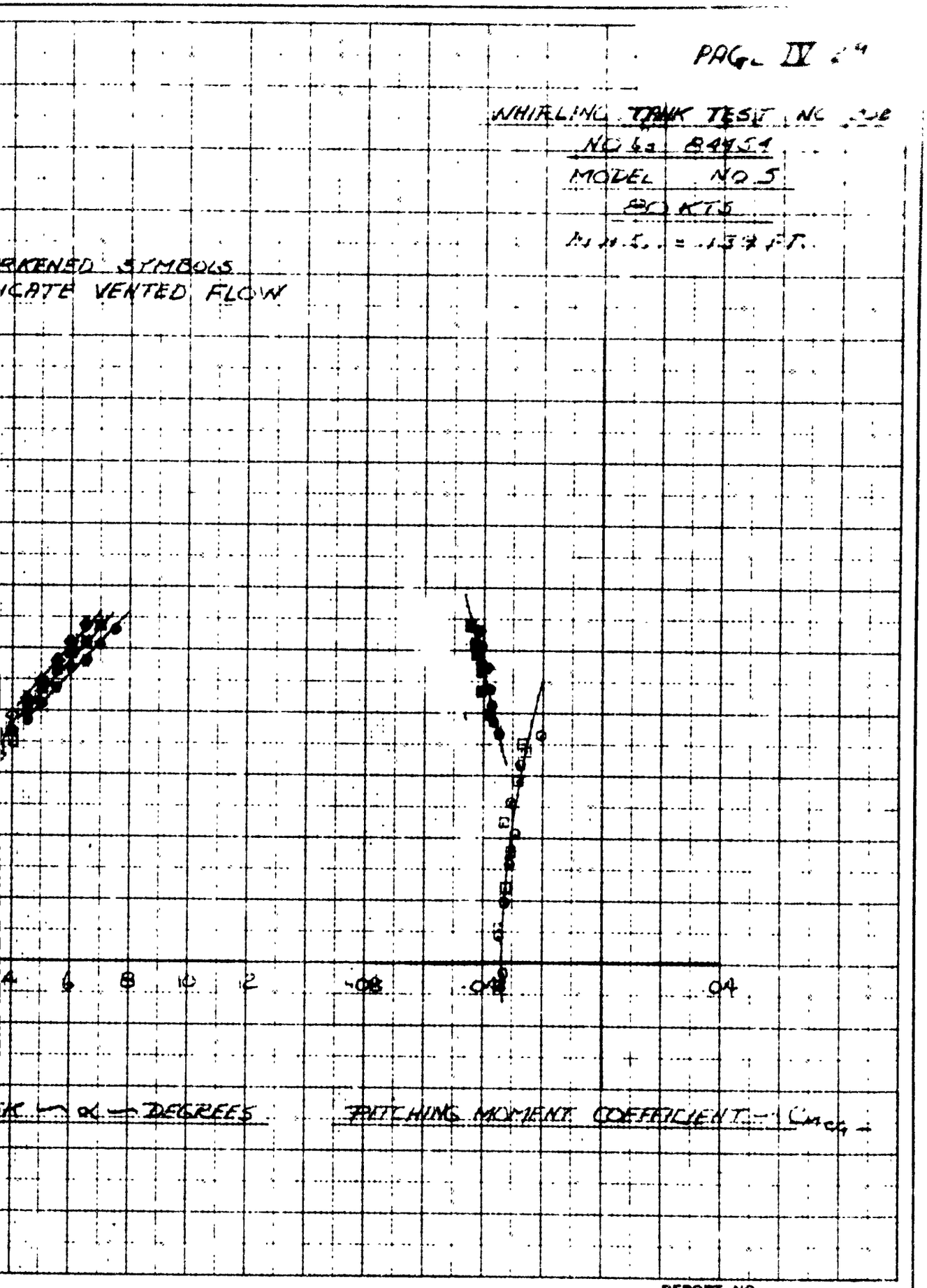
NGINEERING CORPORATION

FROUDE NO.	SYMBOL	d/L	$C_{D_{min}}$	CAV. NO
6.40	◆	.75	.0032	.175
5.56	●	1.00	.0040	.189
5.00	◆	1.25	.0056	.203

NOTE:
1. TOBER
INDICA

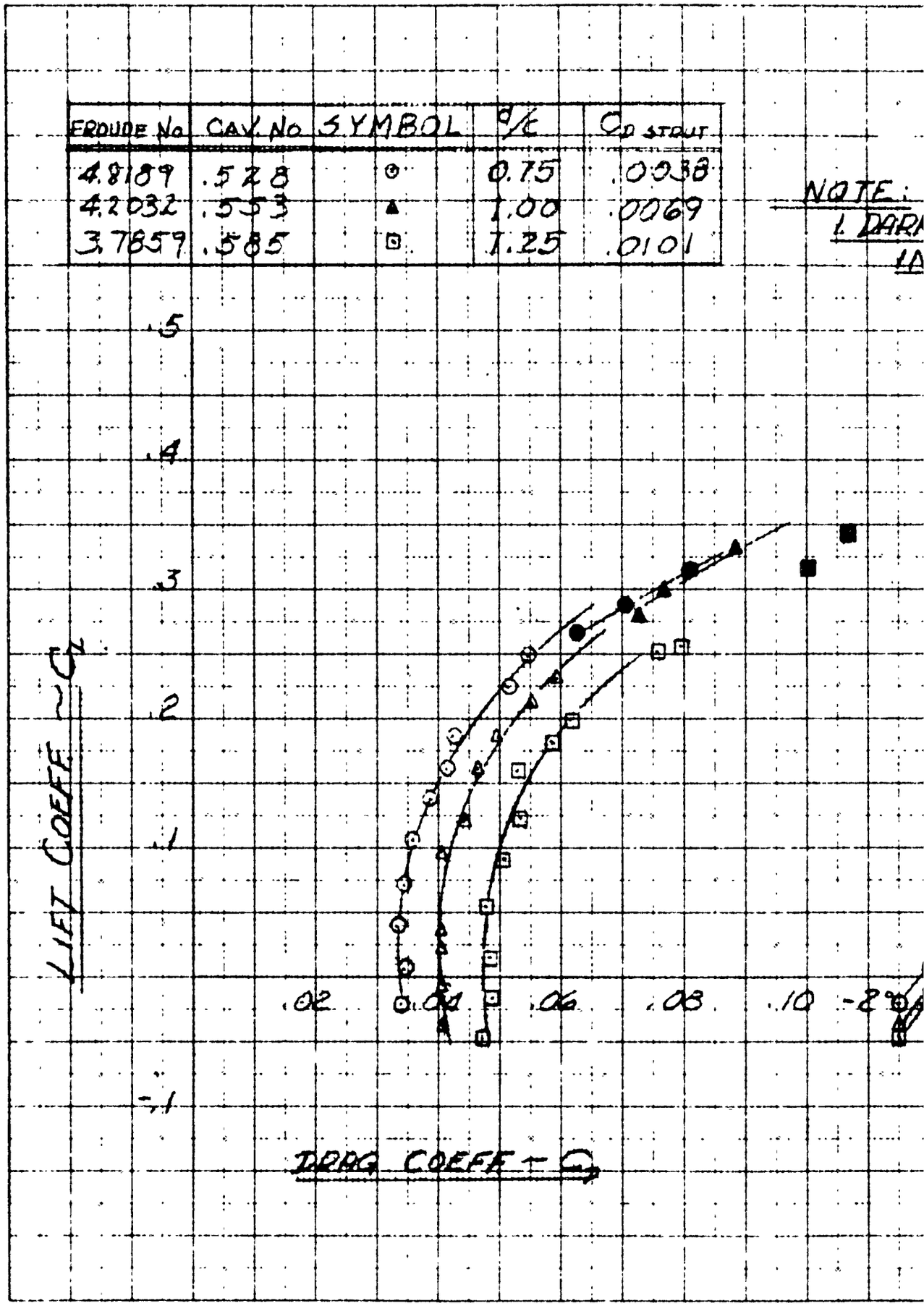


K+E ALBANENE 1967


PAGE IV
WHIRLING TANK TEST NO
NO 6a 84454
MODEL NO 5
80 KTS
RKENED SYMBOLS
ICATE VENTED FLOW
4
6
8
10
12
-.08
-.04
.04
K ~ α ~ DEGREES
PITCHING MOMENT COEFFICIENT ~ $C_{m_{cg}}$

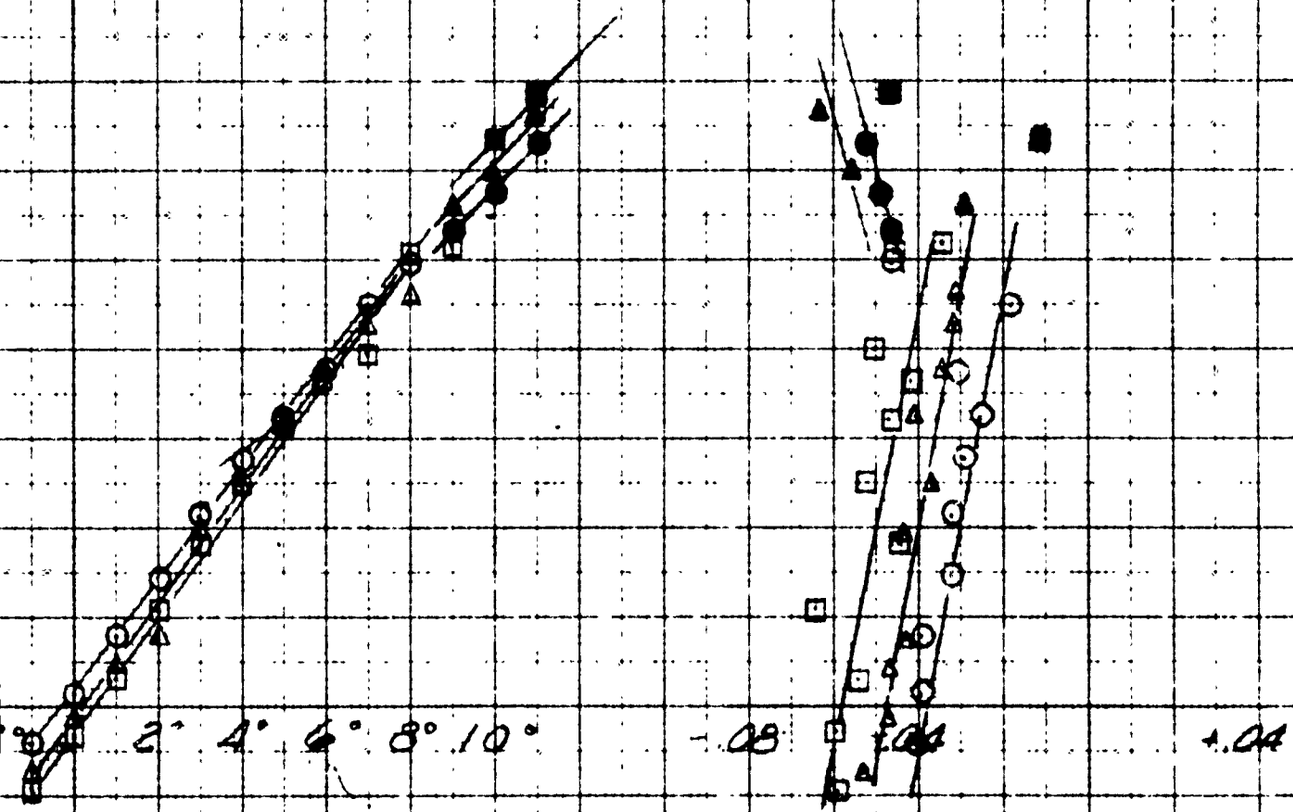
FROUDE No	CAV. No	SYMBOL	d/c	C_D STOUT
4.8189	.528	⊙	0.75	.0038
4.2032	.553	▲	1.00	.0069
3.7859	.585	⊡	1.25	.0101

NOTE:
1. DARK
1A



WHIRLING TANK TEST NO 20F
BUSHIPS NO 6
40 KTS
MAC = 2.50 FT

F.
ARKENED SYMBOLS
INDICATE VENTED
FLOW.

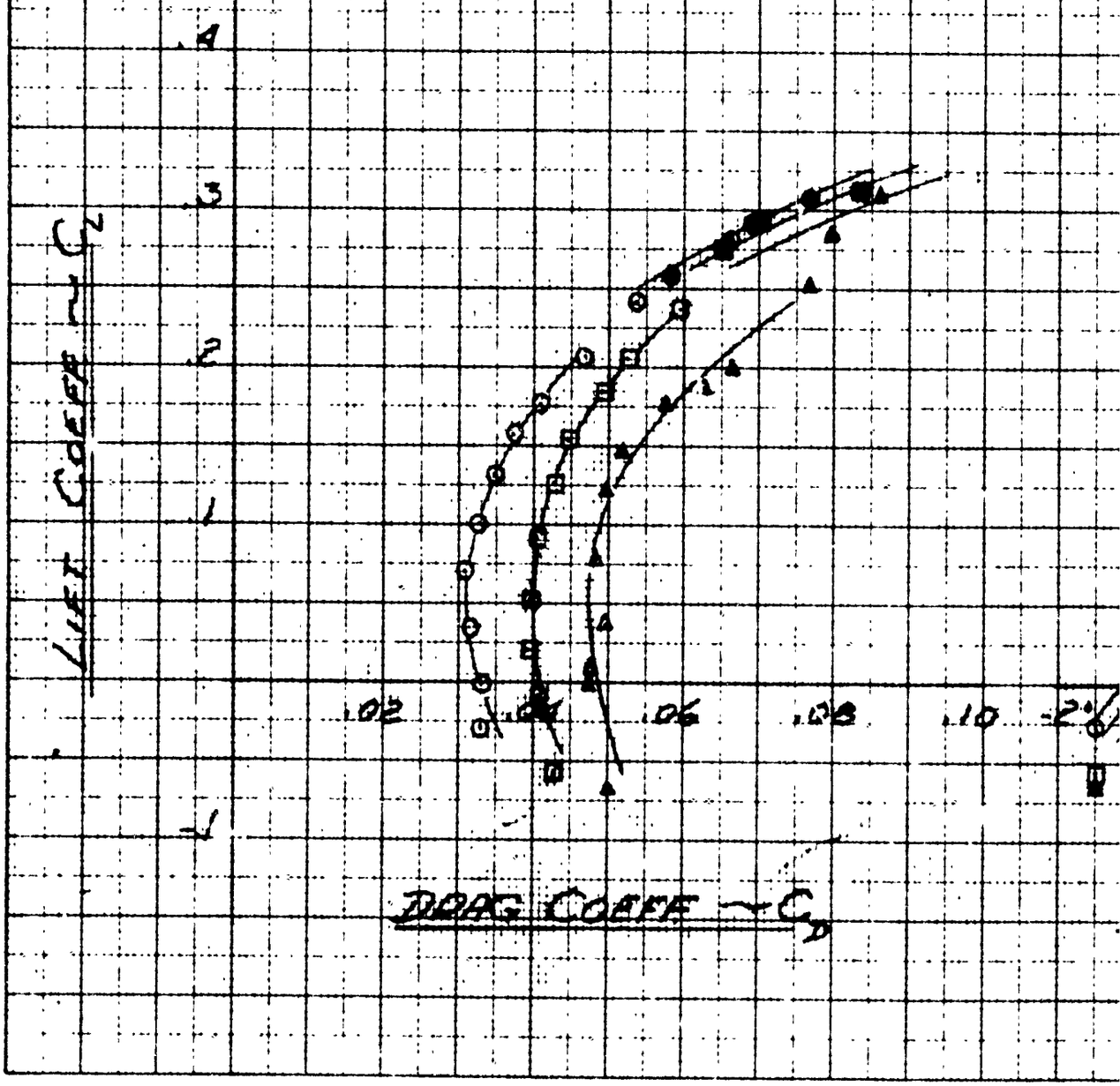


ANGLE of ATTACK
α - DEGREES

PITCHING MOM
COEFF. $C_{M_{c/4}}$

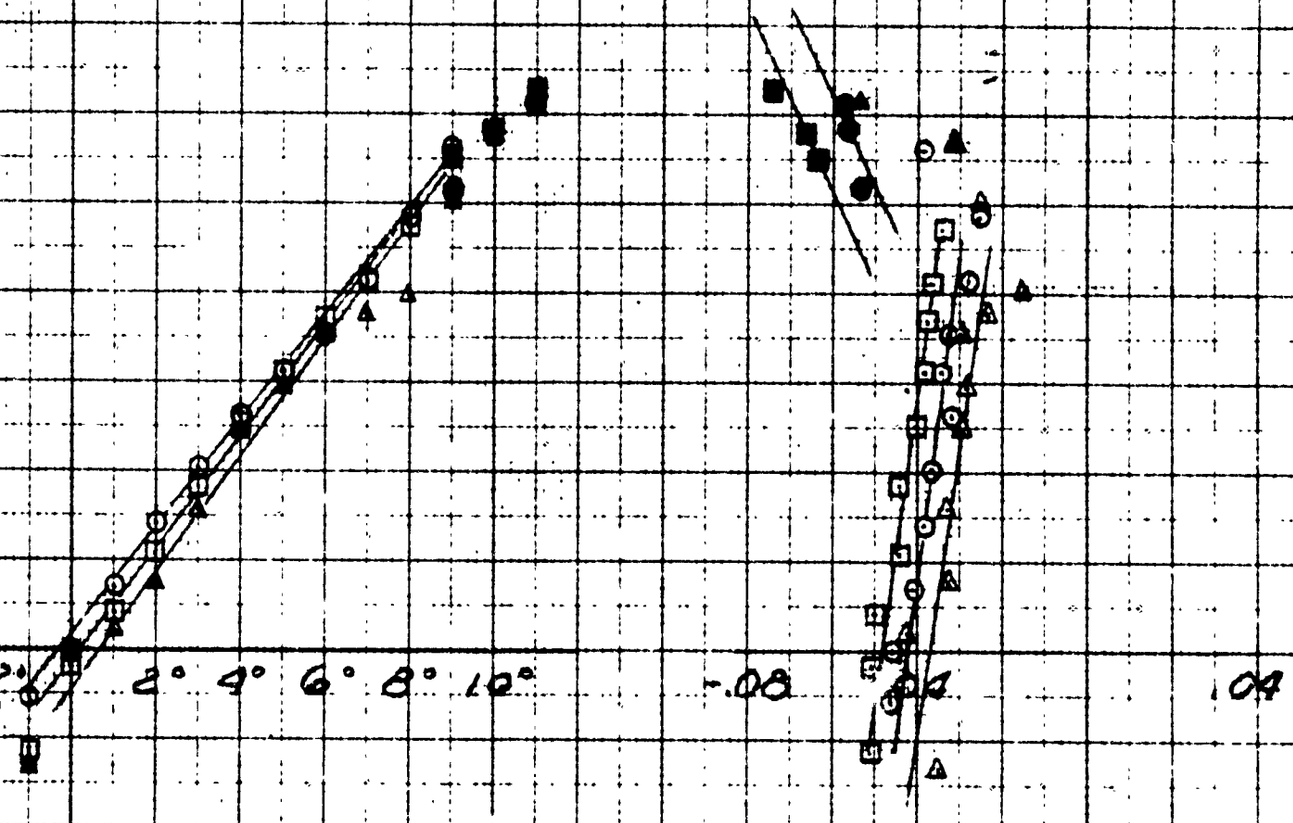
FROUDE No	CAV. No	SYMBOL	a/c	C_D STRUT
4.8189	.435	⊙	0.75	.0046
4.2032	.458	⊡	1.00	.0072
3.7859	.485	▲	1.25	.0103

NOTE
1. D



WHIRLING TANK TEST NO. 20 F
BUSHIRS NO. 6
15 KTS

TE.
DARKENED SYMBOLS
INDICATE VENTED
FLOW.

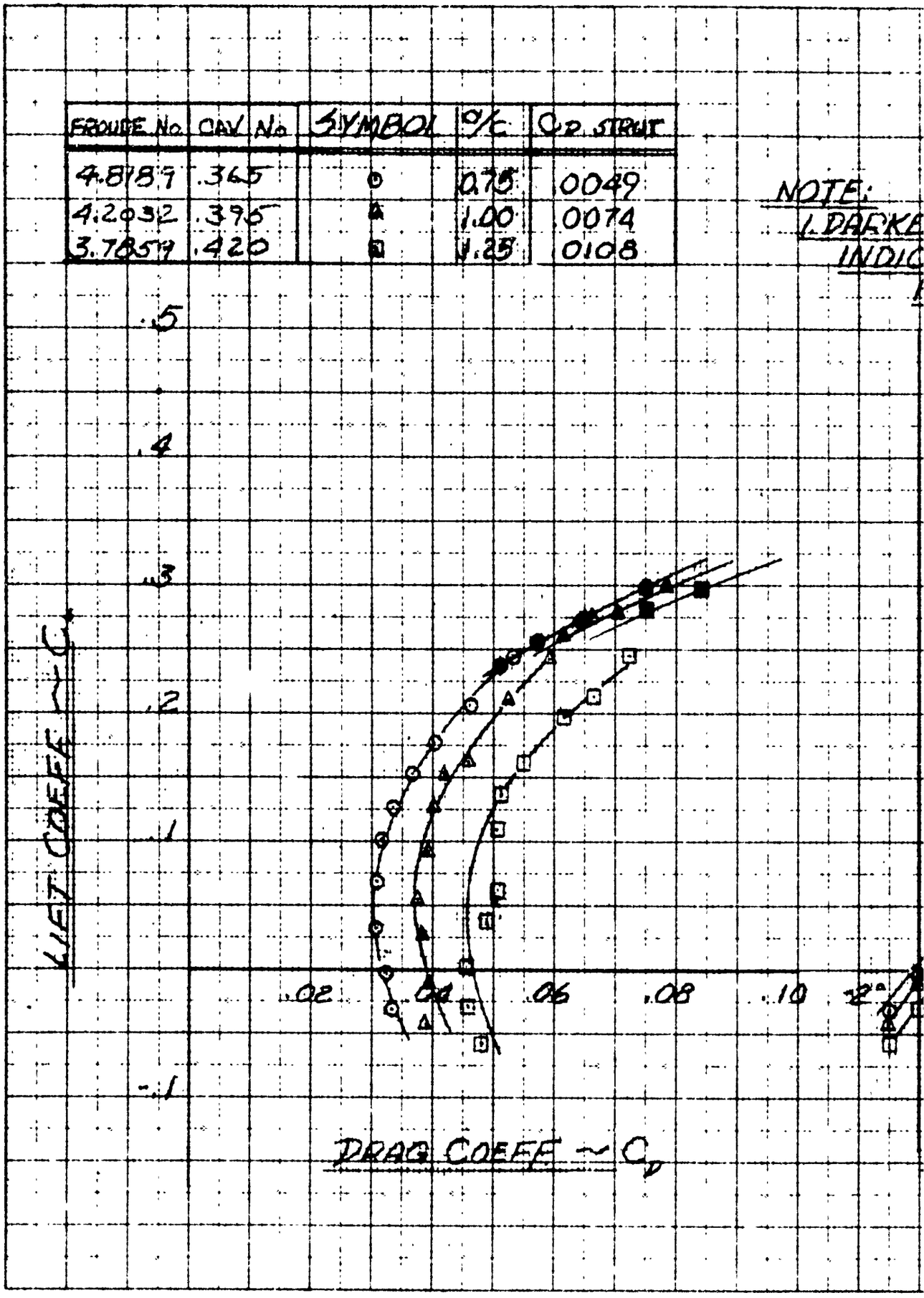


ANGLE of ATTACK
α — DEGREES

PITCHING MOM.
COEFF — $C_{M_{d/4}}$

FROUDE No.	CAV No.	SYMBOL	t/c	C_D STRUT
4.8787	.365	○	0.75	.0049
4.2032	.396	△	1.00	.0074
3.7859	.420	□	1.25	.0108

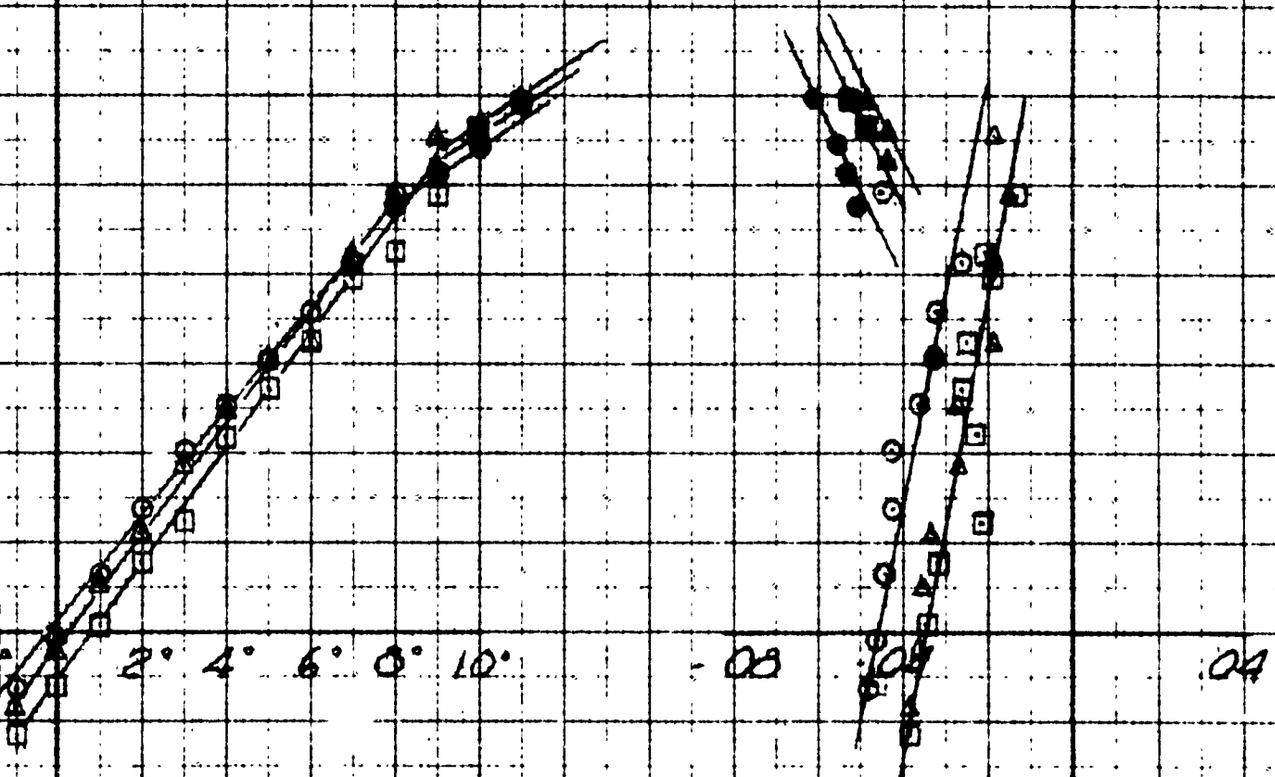
NOTE:
1. DARKA
INDIC



K-E

WHIRLING TANK TEST NO. 20 F
BUSHIPS NO. 6
50 KTS.
MAC = 250 FT

CKENED SYMBOLS
DICATE VENTED
FLOW.

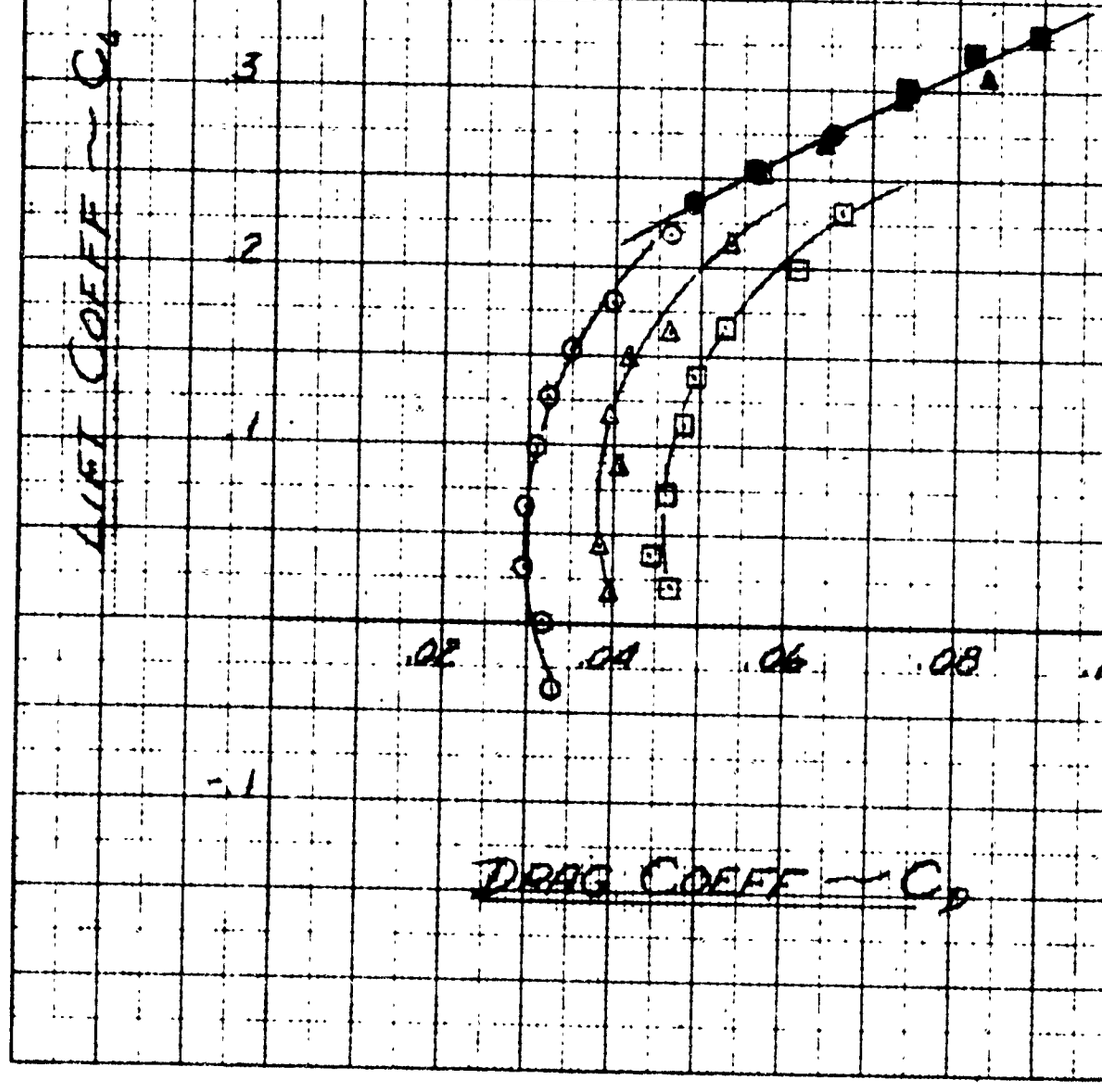


ANGLE OF ATTACK
α ~ DEGREES

PITCHING MOM
COEFF ~ $C_{M_{C/4}}$

FROUDE No.	Cav. No.	SYMBOL	%c	C_D STRUT
4.8189	.284	⊙	0.75	.0052
4.2032	.307	△	1.00	.0078
3.7859	.336	□	1.25	.0112

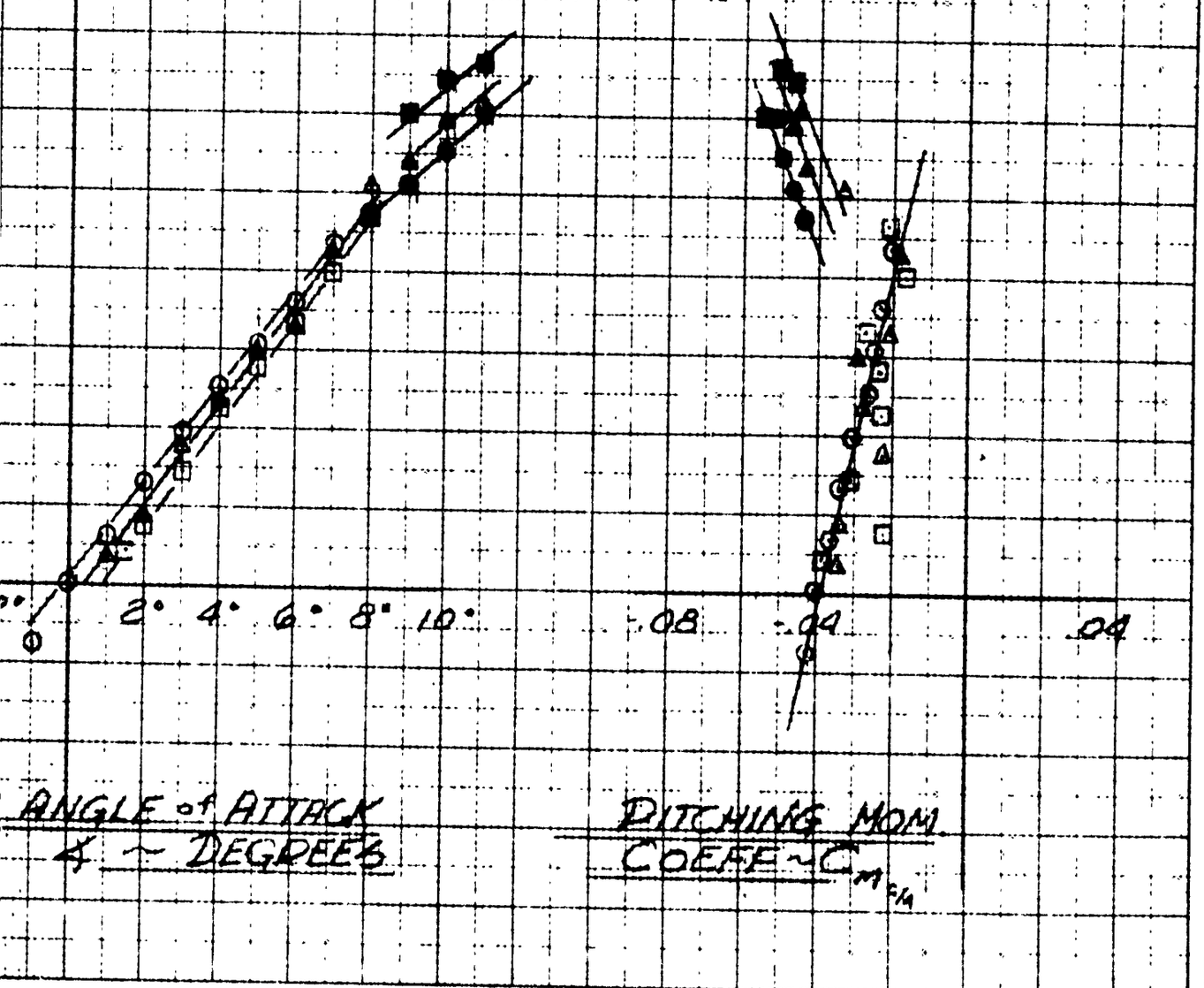
NOTE:
L. DARK
IND



K•E

WHIRLING TANK TEST NO. 20F
BUSHIPS NO. 6
60 KTS.

RKENED SYMBOLS
NDICATE VENTED
FLOW.

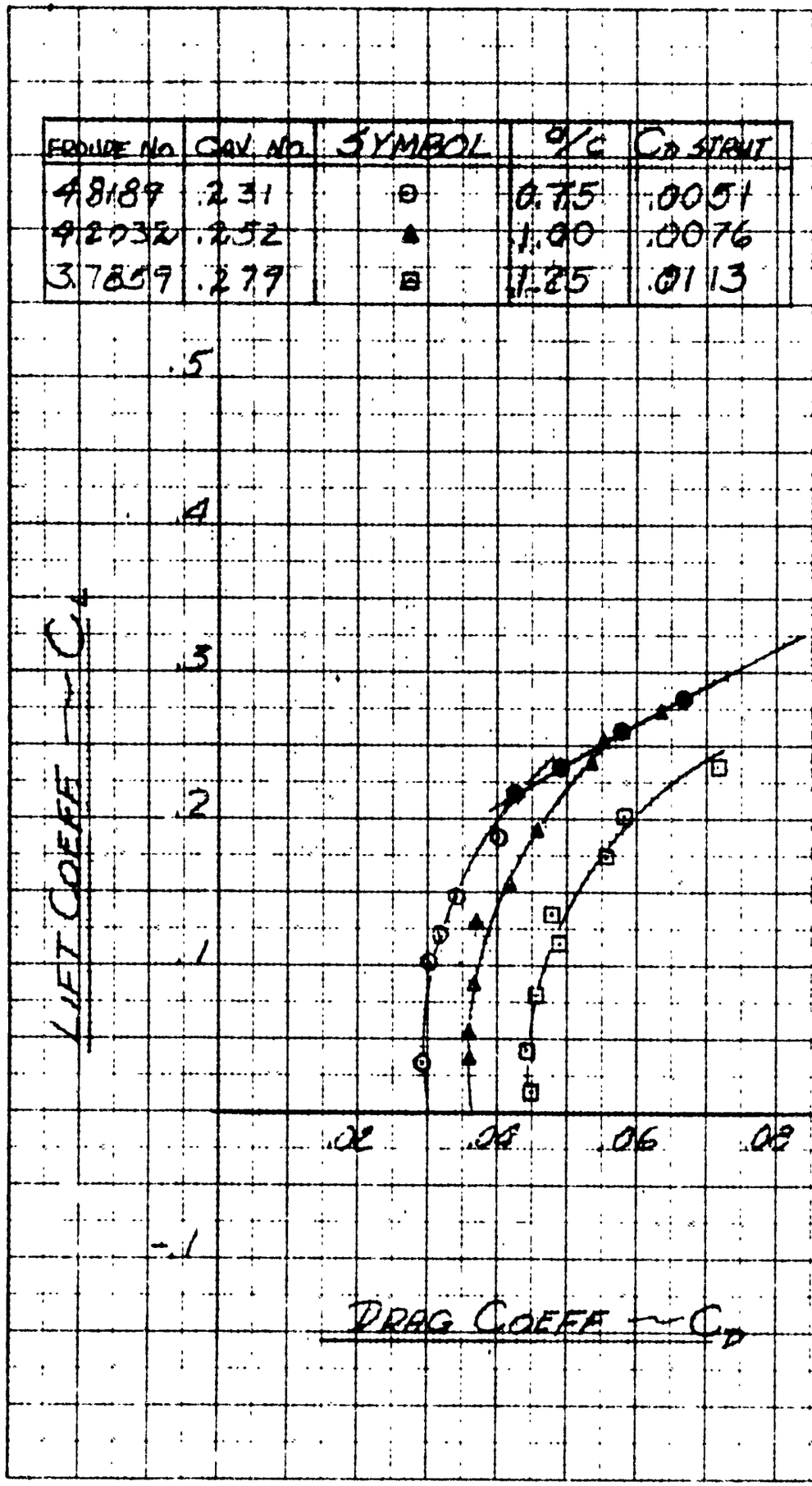


ANGLE of ATTACK
α ~ DEGREES

PITCHING MOM.
COEFF ~ $C_{m_{F/A}}$

FROUDE NO	CAV. NO.	SYMBOL	ℓ/c	C_D STRUT
48187	.231	⊖	0.75	.0051
42032	.252	▲	1.00	.0076
37859	.279	⊡	1.25	.0113

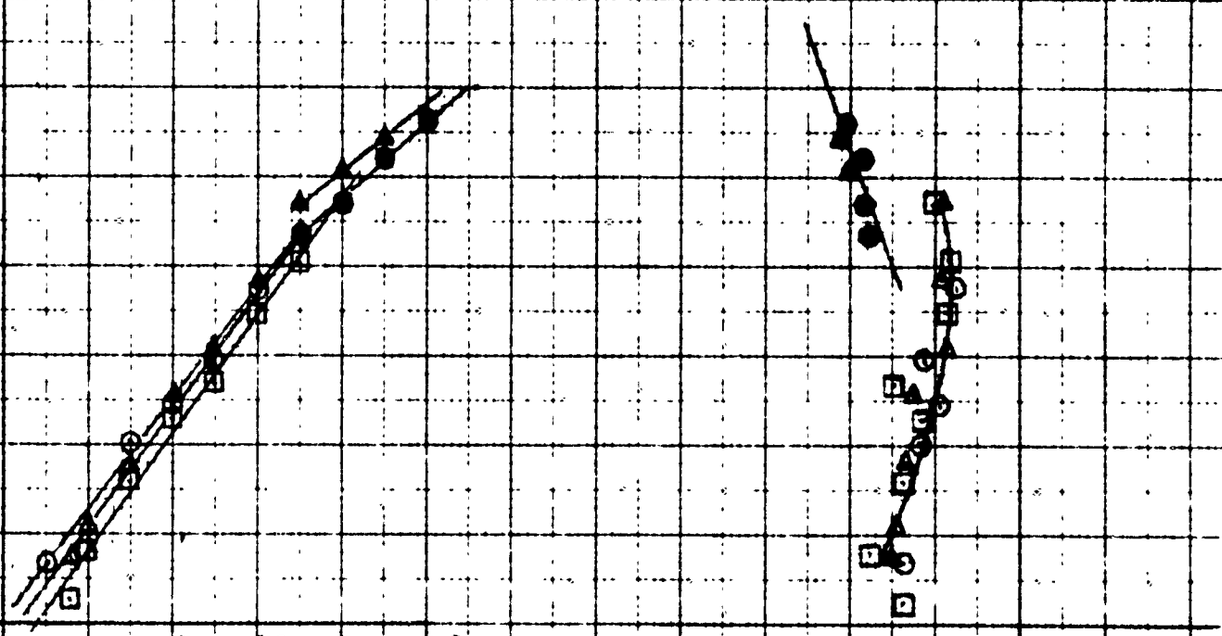
NOTE
1. DA



K-E

WHIRLING TANK TEST NO 20F
BUSHIPS NO. 6
70 KTS

TE:
DARKENED SYMBOLS
INDICATE VENTED
FLOW.



2° 4° 6° 8° 10° -.08 -.04 +.04

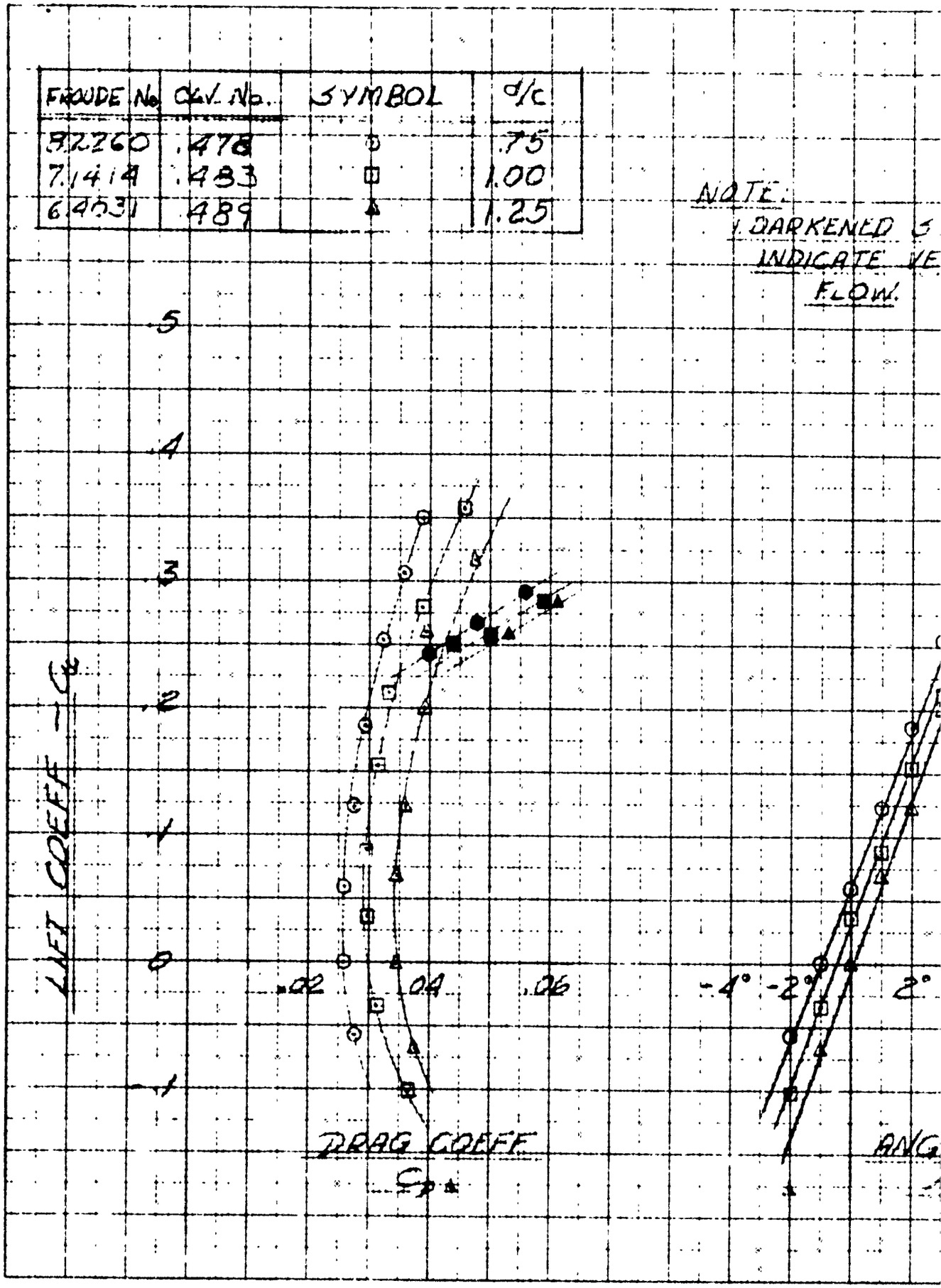
ANGLE of ATTACK
α — DEGREES

PITCHING MOM
COEFF — $C_{M_{q/q}}$

FT ENGINEERING CORPORATION

FROUDE No.	CAV. No.	SYMBOL	d/c
9.2260	.478	○	.75
7.1414	.483	□	1.00
6.4031	.489	△	1.25

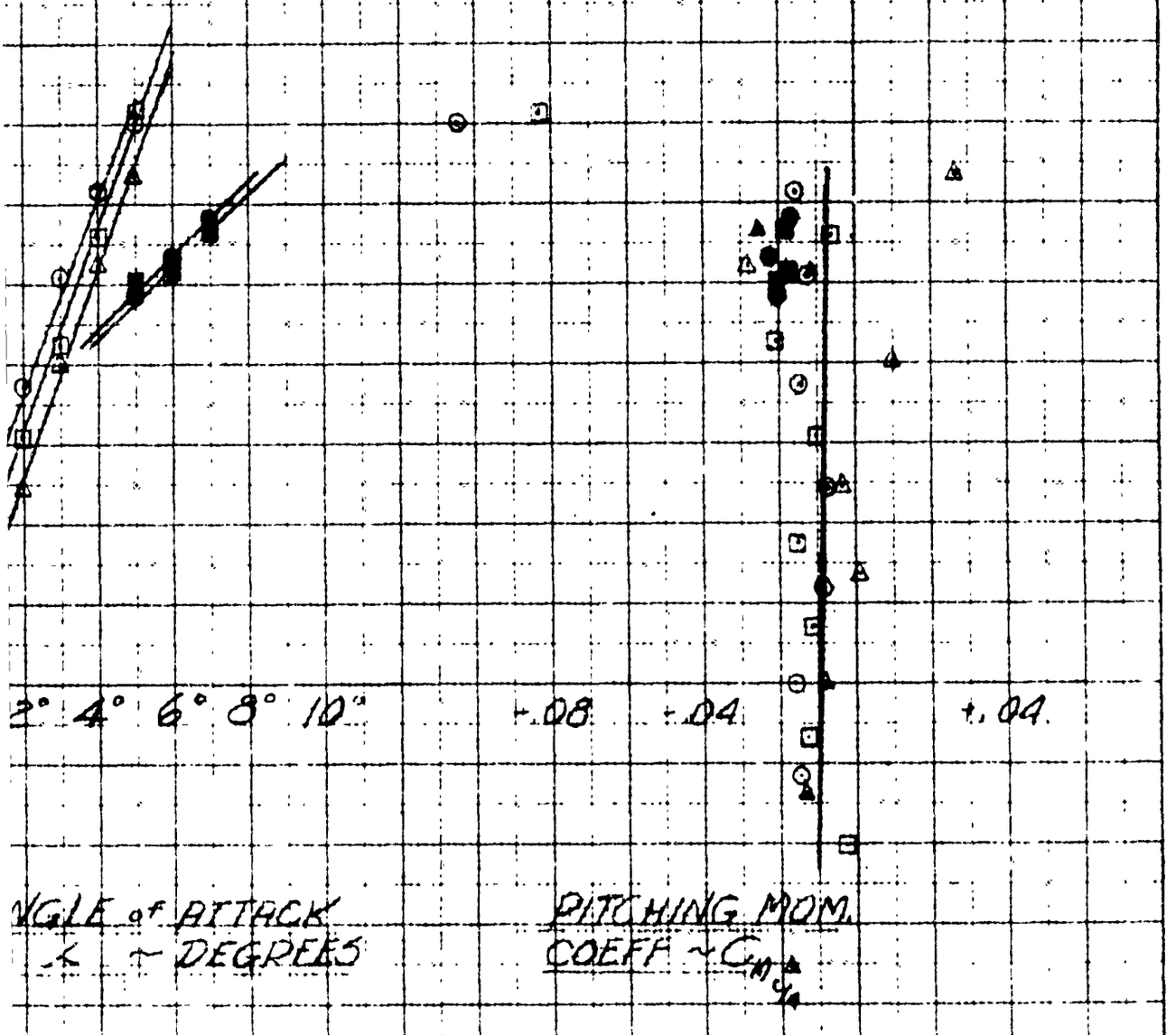
NOTE:
DARKENED S
INDICATE VE
FLOW.



K+E

WHIRLING TANK TEST NO. 20D
BUSHIPS NO 7
40 KTS
M.A.C. = .093 FT

SYMBOLS
VENTED

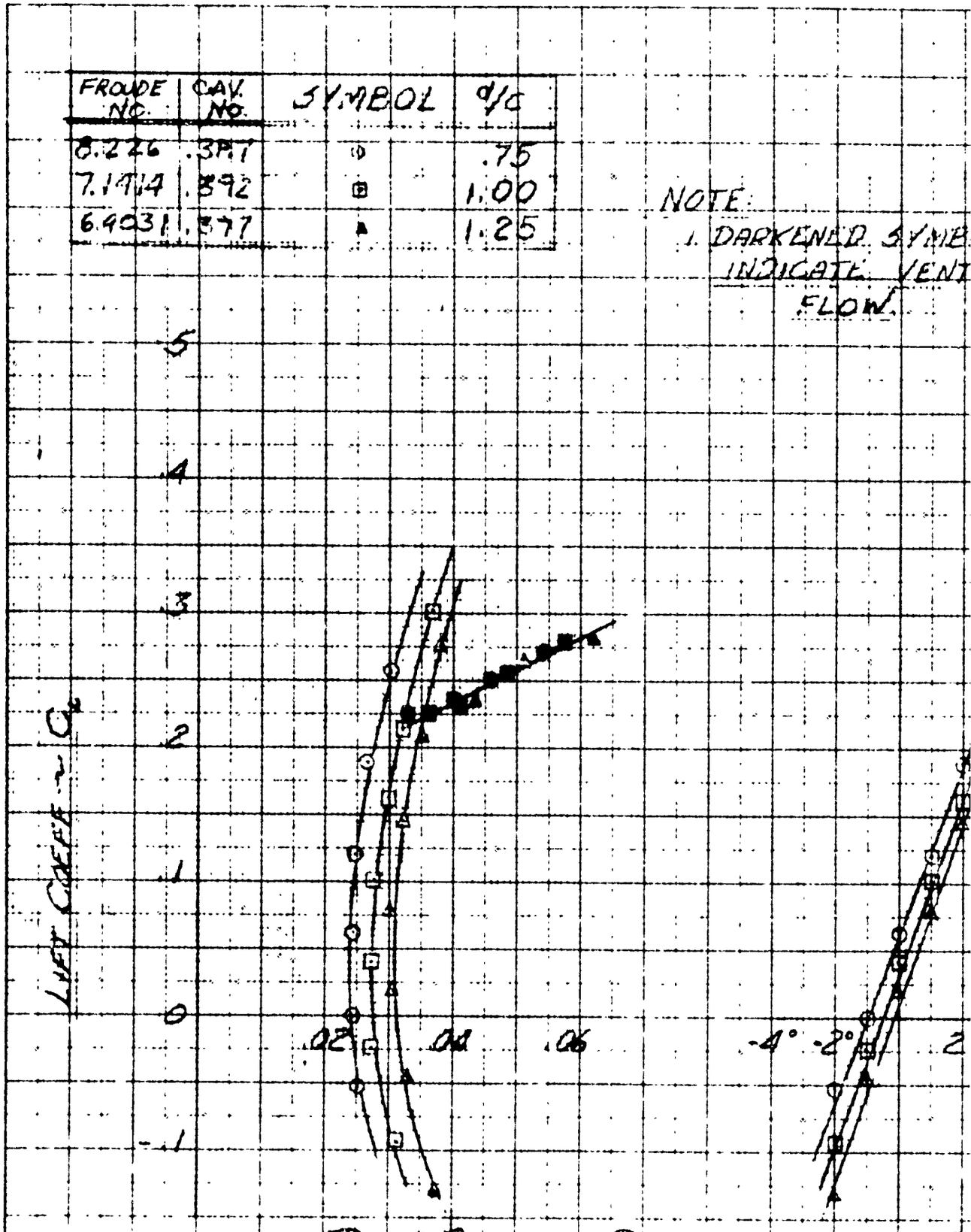


ANGLE of ATTACK
α + DEGREES

PITCHING MOM.
COEFF - $C_{m_{c/4}}$

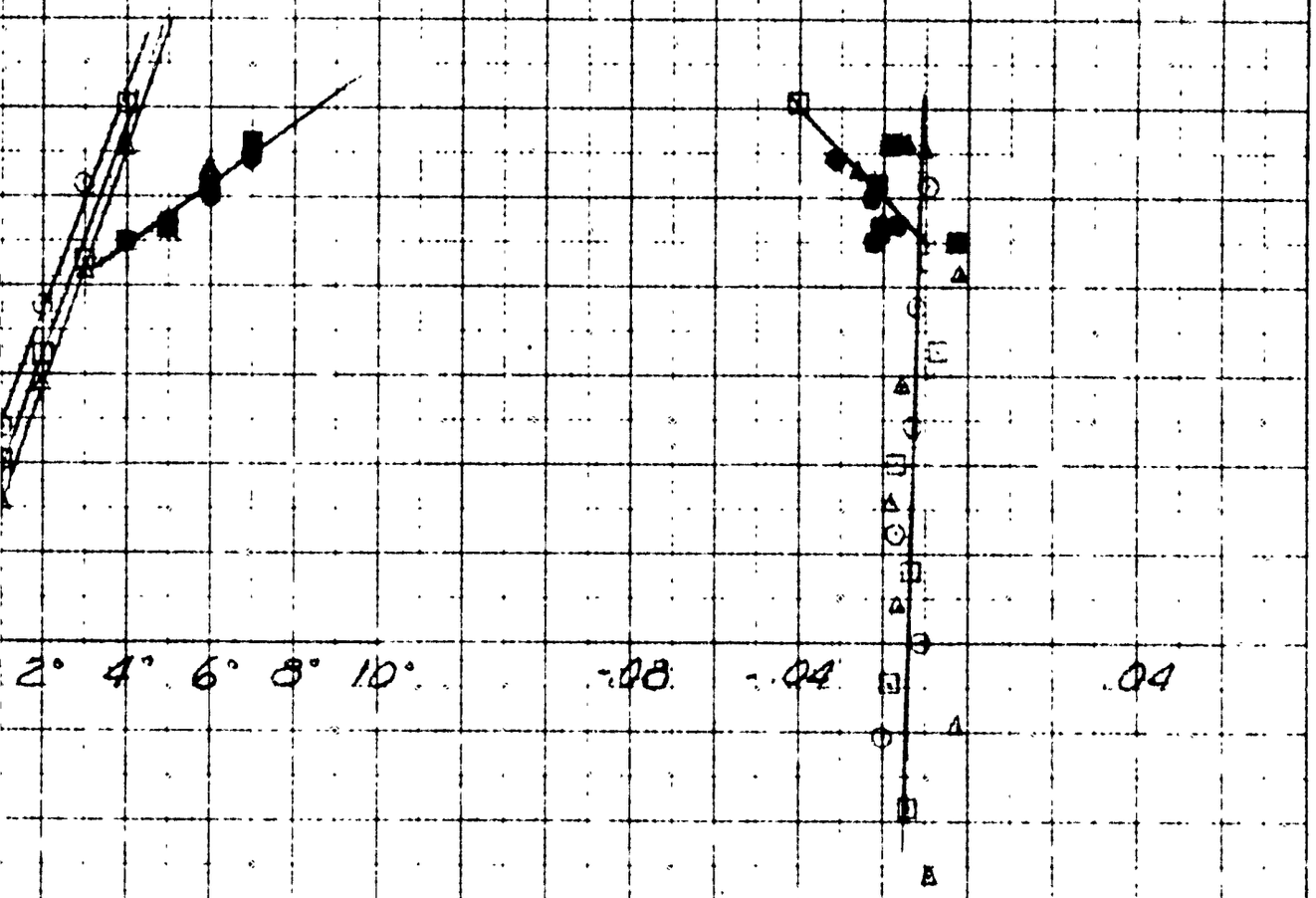
FROUDE NO.	CAV. NO.	SYMBOL	d/c
8.226	.391	⊙	.75
7.114	.392	⊞	1.00
6.4031	.377	▲	1.25

NOTE
1. DARKENED SYME
INDICATE VENT
FLOW.



WHIRLING TANK TEST NO 20D
BUSHIPS NO. 7
45 KTS.
M.A.C. = 08.7 FT

MBOLS
NTED

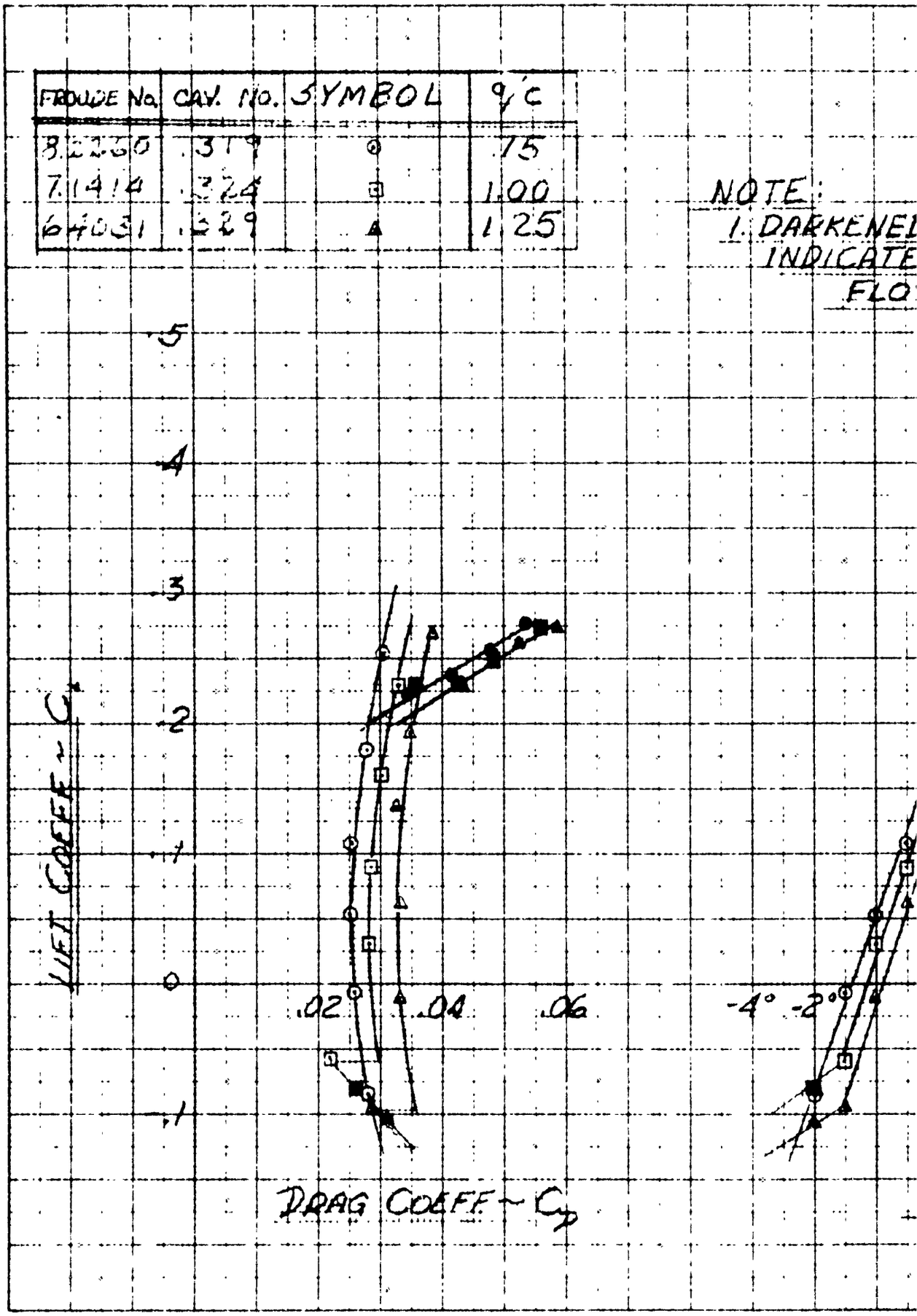


ANGLE OF ATTACK
AT DEGREES

PITCHING MOM.
COEFF - $C_{M_{c/a}}$

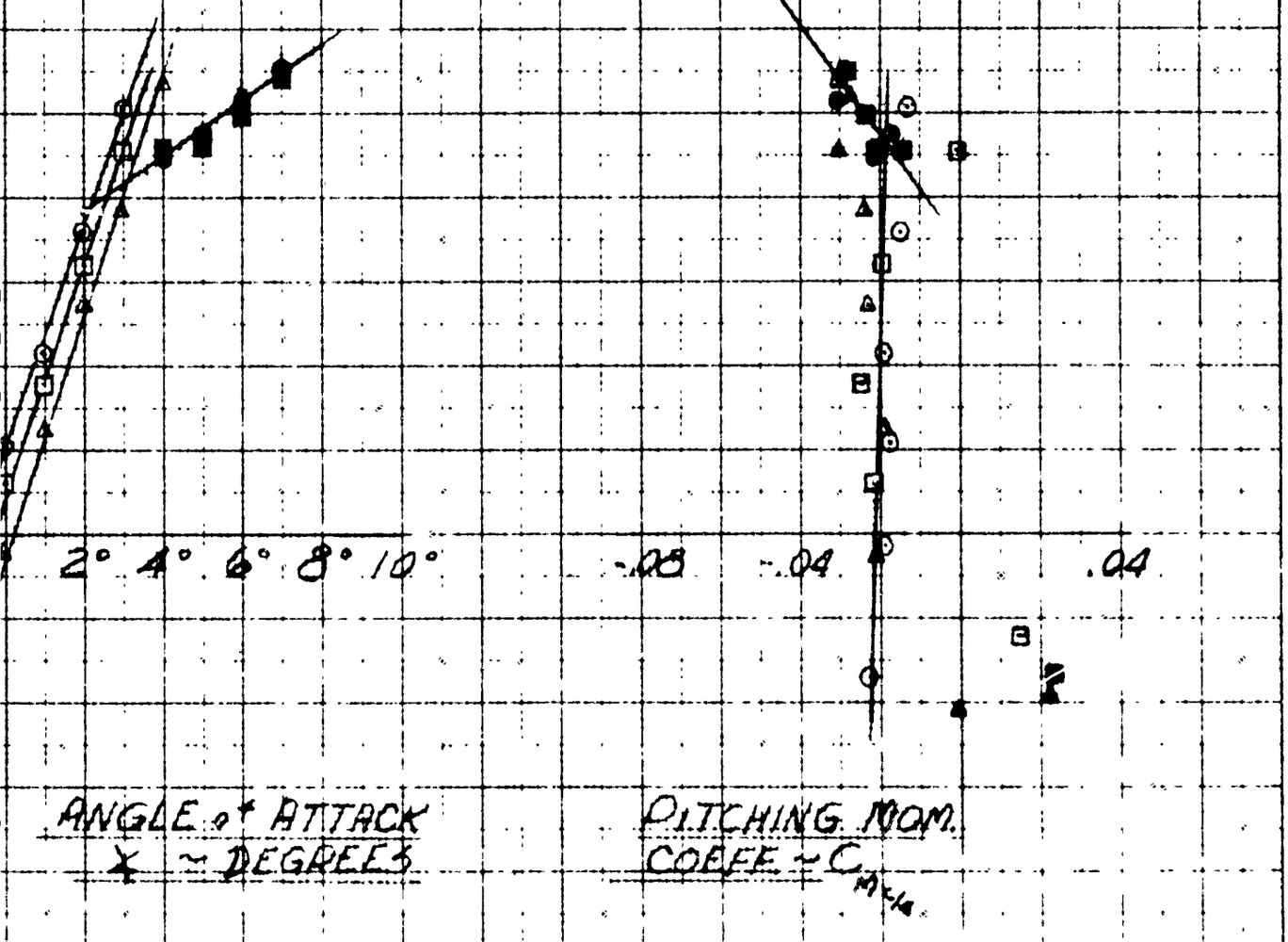
FROUDE No.	CAV. No.	SYMBOL	9/c
8.2230	.319	⊙	.75
7.1414	.324	⊡	1.00
6.4031	.329	▲	1.25

NOTE:
1. DARKENED
INDICATE
FLO



WHIRLING TANK TEST NO 20D
BUSHIPS NO. 7
50 KTS
M.A.C. = .283 FT

VED SYMBOLS
TE VENTED
LOW.

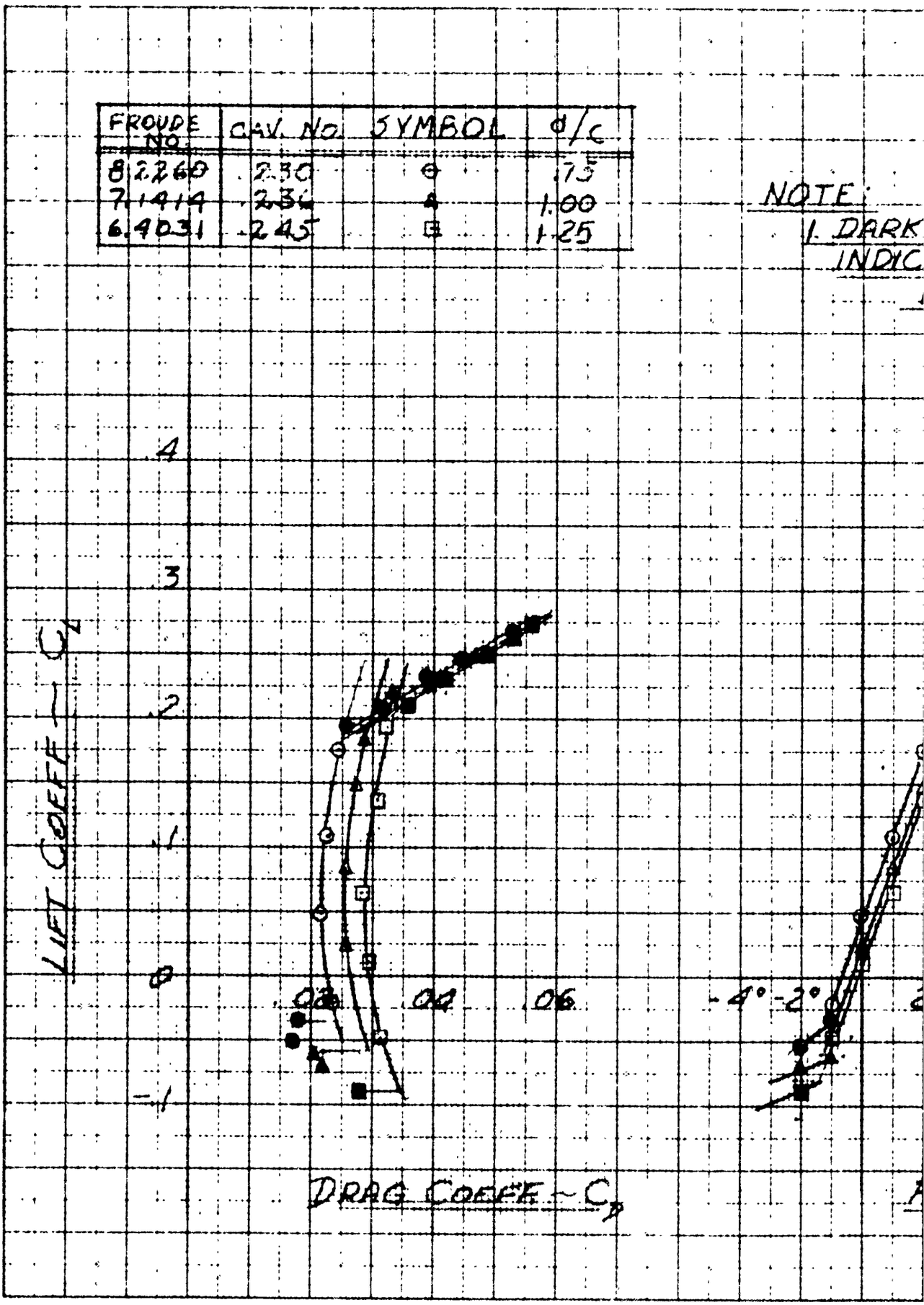


ANGLE of ATTACK
α = DEGREES

PITCHING MOM.
COEFF = $C_{M_{1/4}}$

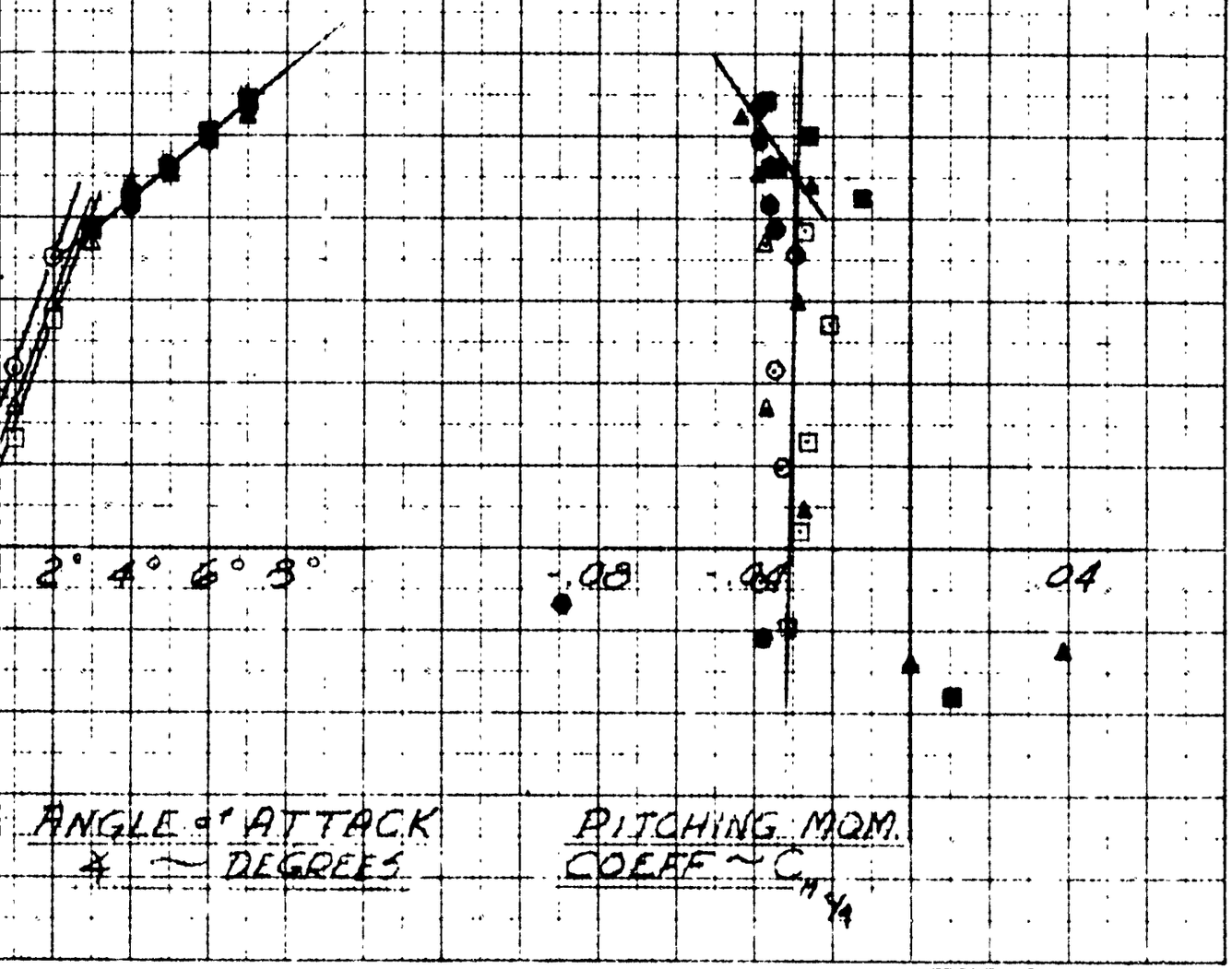
FROUDE NO.	CAV. NO.	SYMBOL	d/c
8.2260	.230	○	.75
7.1414	.236	△	1.00
6.4031	.245	□	1.25

NOTE:
1. DARK
INDIC



WHIRLING TANK TEST NO 20D
BUSHIPS NO 7
60 KTS
M.A.C. = .083 FT

RKENED SYMBOLS
DICATE VENTED
FLOW.

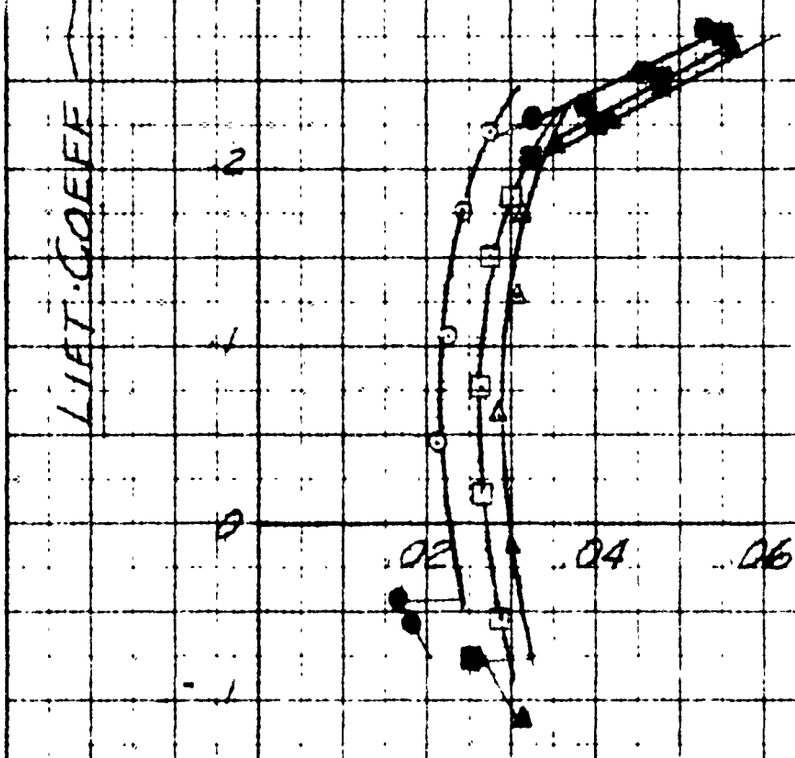


ANGLE of ATTACK
α — DEGREES

PITCHING MOM.
COEFF — $C_{M_{1/4}}$

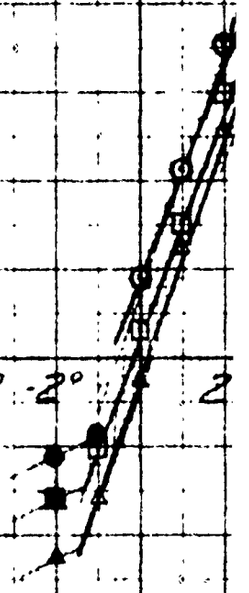
FROUDE NO	CAV. No	SYMBOL	ℓ/c
8.2260	.178	⊖	75
7.1414	.185	⊟	1.00
6.4031	.192	▲	1.25

NOTE:
1. PARKE
INDICA
FI



LIFT COEFF ~ C_L

DRAG COEFF ~ C_D

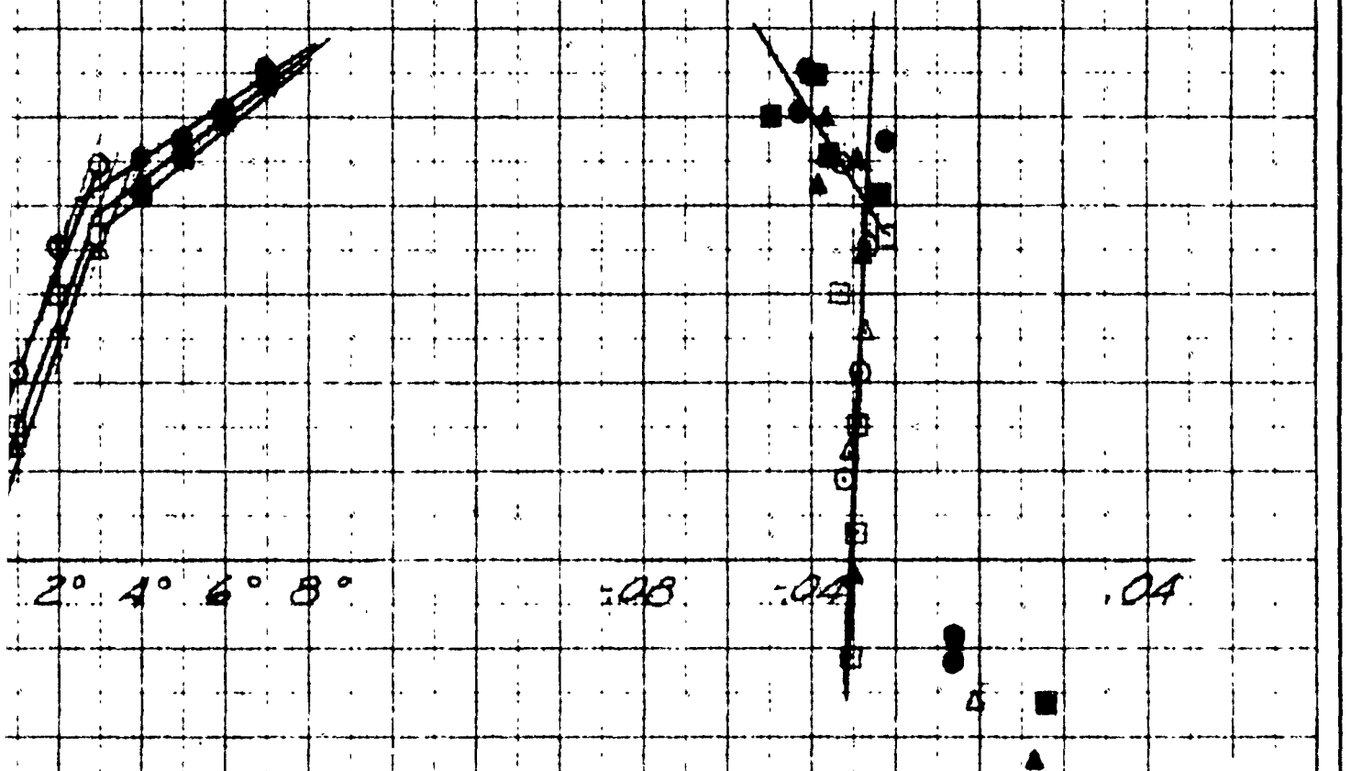


AN
4

K-E

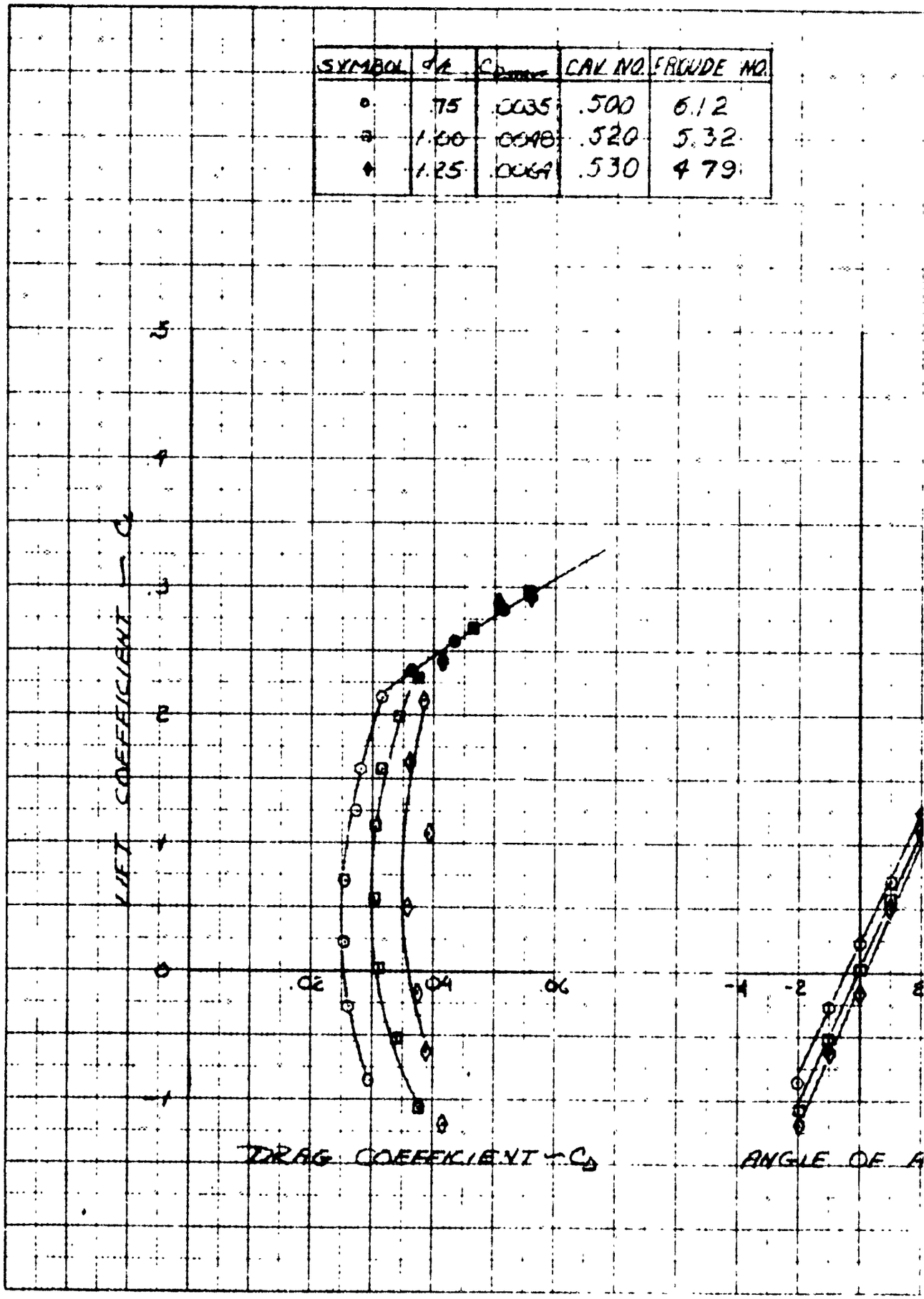
WHIRLING TANK TEST NO 20 D
BUSHIPS NO 7
70 KTS
M.A.C. = .083 FT

KENED SYMBOLS
ICATE VENTED
FLOW



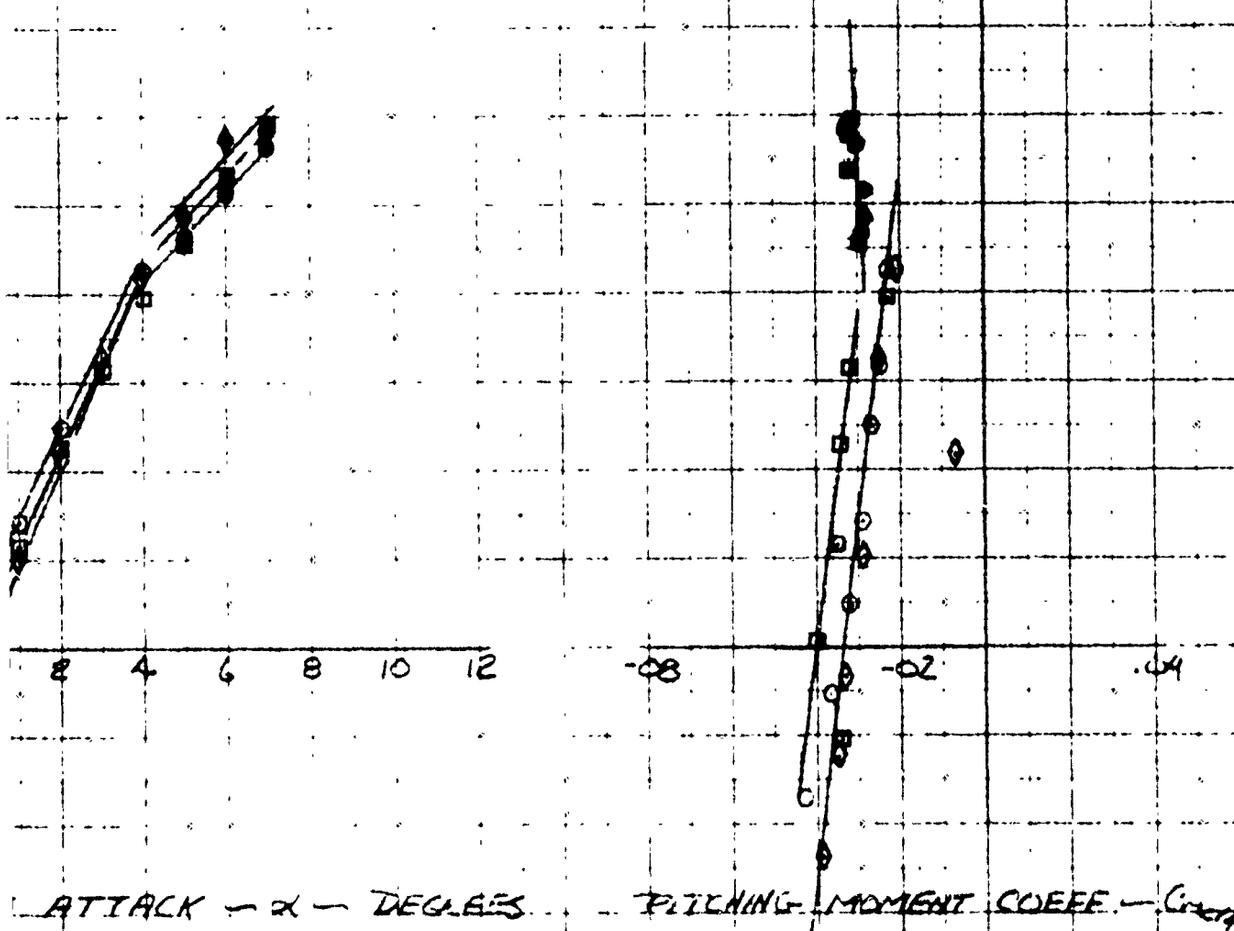
ANGLE of ATTACK
α — DEGREES

PITCHING MOM.
COEFF — $C_{M_{C/4}}$


SYMBOL
CAV NO.
FROUDE NO.
.75
.0035
.500
6.12
1.00
.0048
.520
5.32
1.25
.0064
.530
4.79
LIFT COEFFICIENT — C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
DRAG COEFFICIENT — C_D
-4
-2
ANGLE OF A

NOTE.
1. DARKENED POINTS INDICATE VENTED FLOW.

WHIRLING TANK TEST NO. 20C
NO.Gs 84454
MODEL NO. 8
40 KTS
MAC = .152 FT

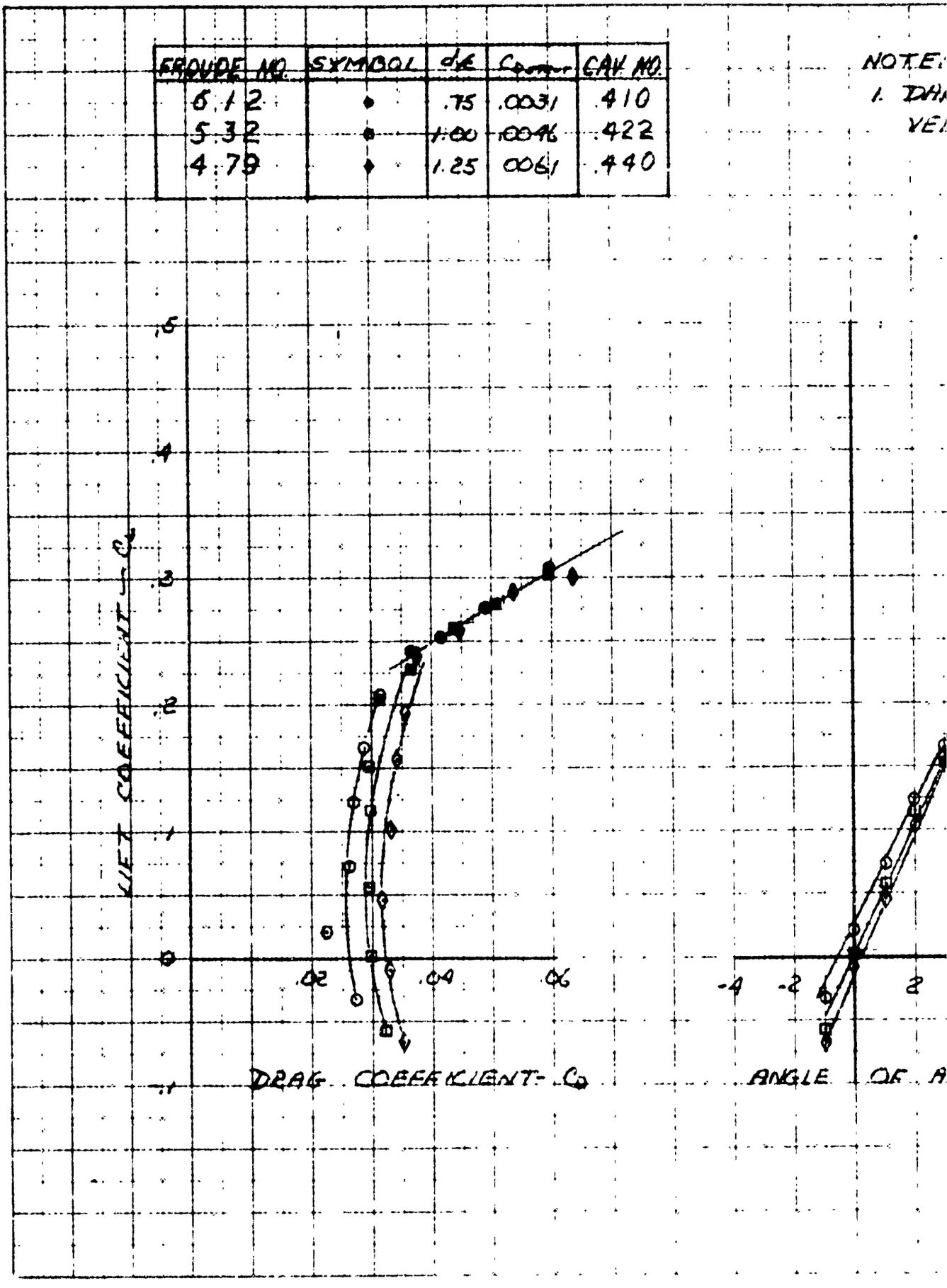


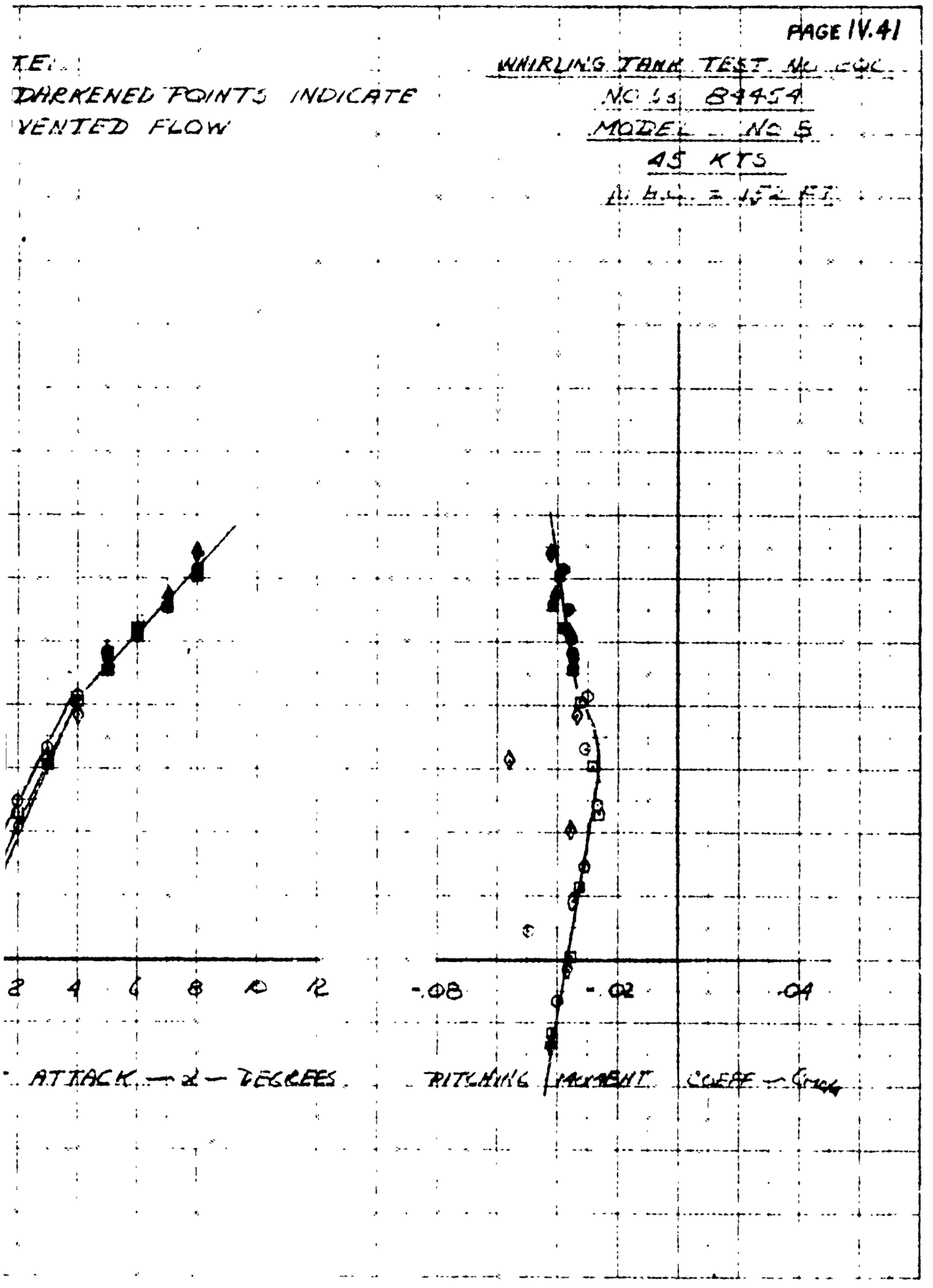
ATTACK — α — DEGREES

PITCHING MOMENT COEFF — $C_{m_{cm}}$

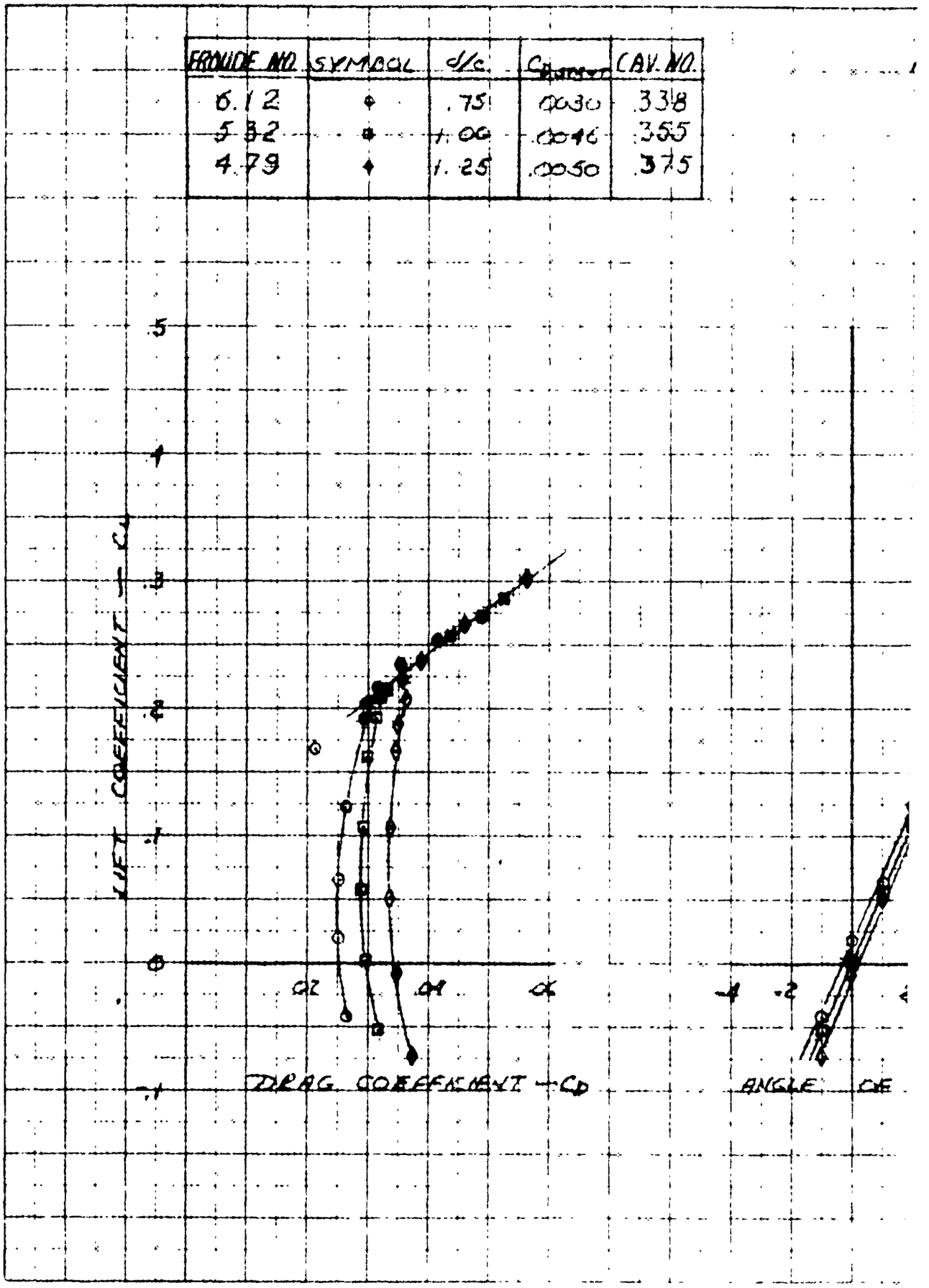
FROUDE NO.	SYMBOL	d/c	C_{cav}	CAV NO.
6.12	♦	.75	.0031	.410
5.32	♦	1.00	.0046	.422
4.79	♦	1.25	.0061	.440

NOTE:
1. DIM
VE




TE:
DARKENED POINTS INDICATE
VENTED FLOW
WHIRLING TANK TEST NO
NO 84454
MODEL NO 5
45 KTS
2
4
6
8
10
12
-.08
-.02
.04
ATTACK — α — DEGREES
PITCHING MOMENT COEFF — Cmcg

FROUDE NO.	SYMBOL	d/c.	C_{BUBBLE}	CAV. NO.
6.12	♦	.75	.0030	.338
5.32	♦	1.00	.0046	.355
4.79	♦	1.25	.0050	.375



WHIRLING TANK TEST NO. 20C

NO. 39454

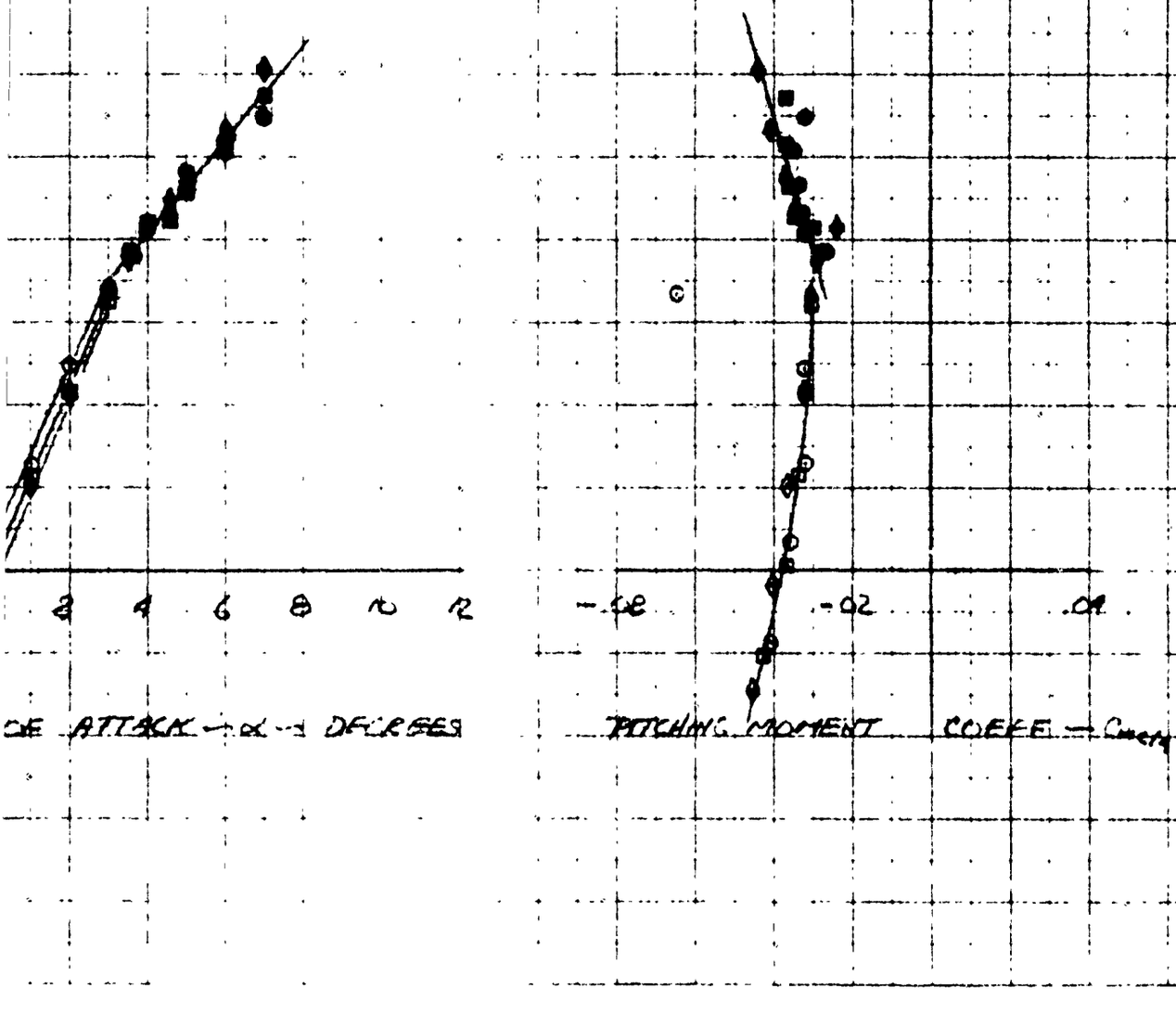
MODEL NO. 8

50 KTS

M.A.C. = .152 FT.

NOTE:

1. DARKENED SYMBOLS INDICATE VENTED FLOW.

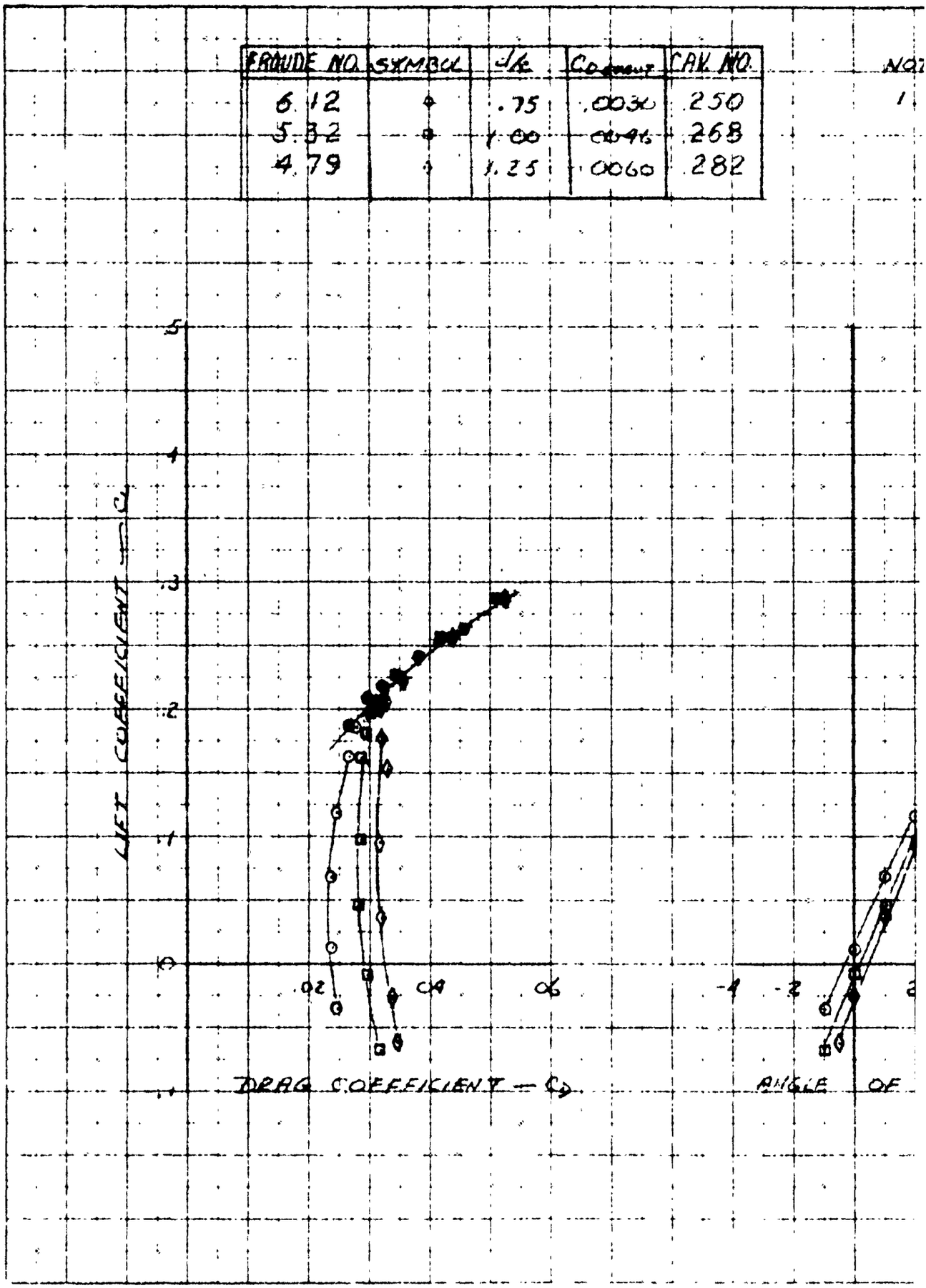


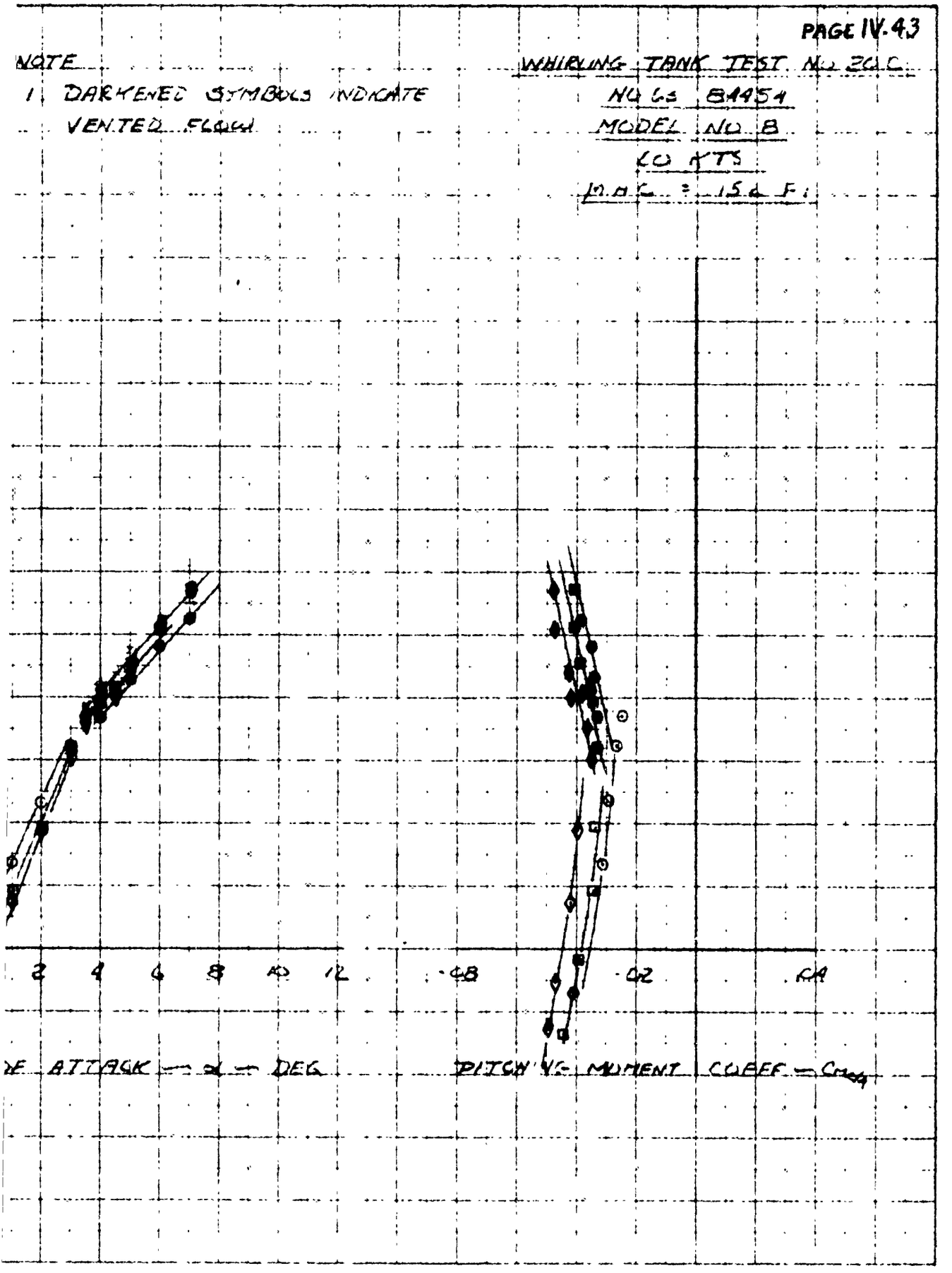
ANGLE OF ATTACK — α — DEGREES

PITCHING MOMENT COEFF. — $C_{m_{c/4}}$

FROUDE NO.	SYMBOL	l/c	$C_{D_{MIN}}$	CAV. NO.
6.12	◇	.75	.0030	.250
5.82	◇	1.00	.0046	.268
4.79	◇	1.25	.0060	.282

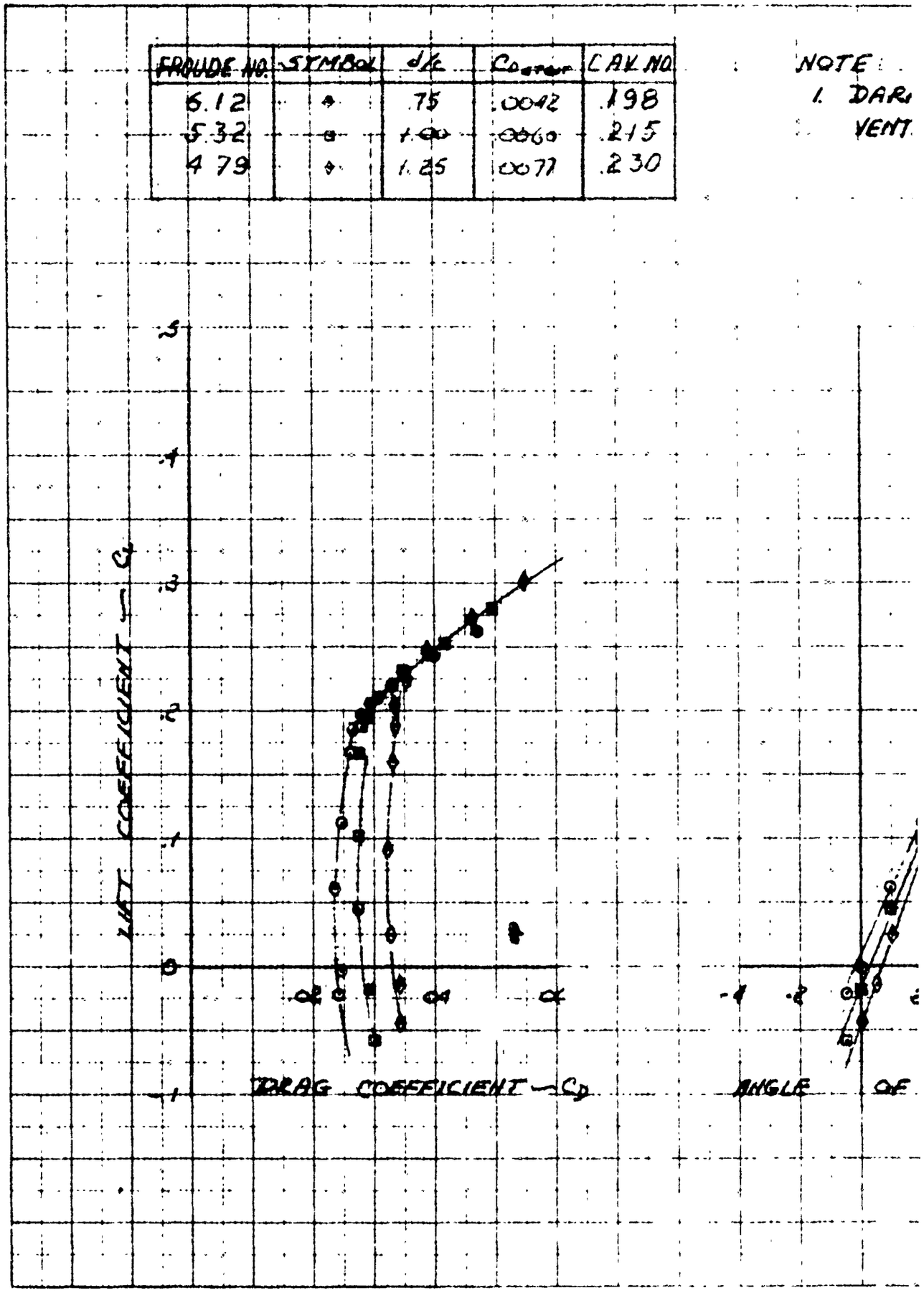
NOT
1




NOTE
1. DARKENED SYMBOLS INDICATE VENTED FLOW
WHIRLING TANK TEST NO 20C
NO GS 84454
MODEL NO 8
60 KTS
M.A.C. = 15.6 FT
2
4
6
8
10
12
-.08
-.02
.04
OF ATTACK — α — DEG
PITCHING MOMENT COEFF — $C_{m_{cg}}$

FROUDE NO.	SYMBOL	d/c	Cavitation	CAV NO.
6.12	◆	.75	.0042	.198
5.32	●	1.00	.0060	.215
4.79	◆	1.25	.0077	.230

NOTE
1. DAR
VENT



WHIRLING TANK TEST NO 20C.

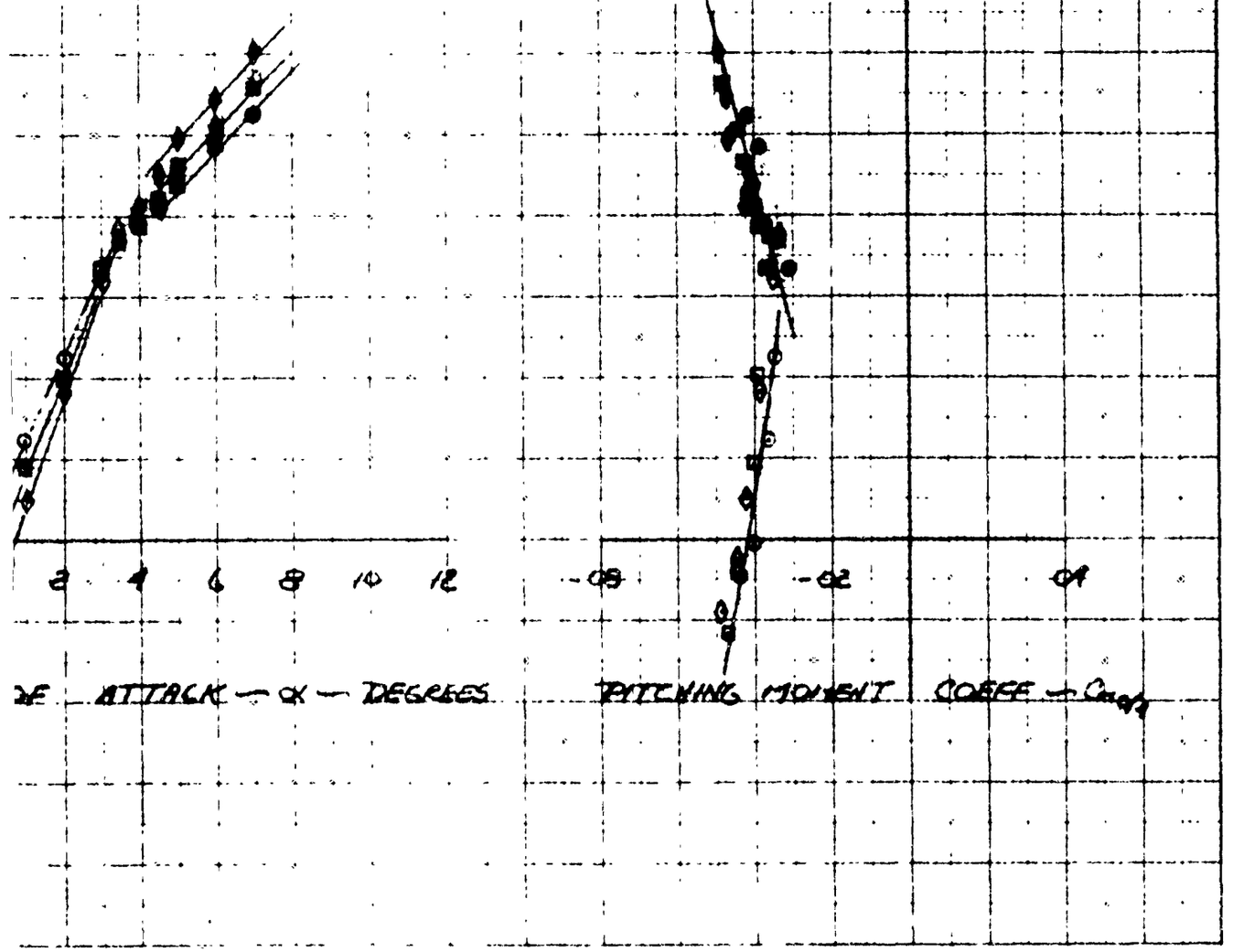
NOGs 84454

MODEL NO8

70 KTS

MAC = .152 FT.

ARKENED SYMBOLS INDICATE
ENTED FLOW.

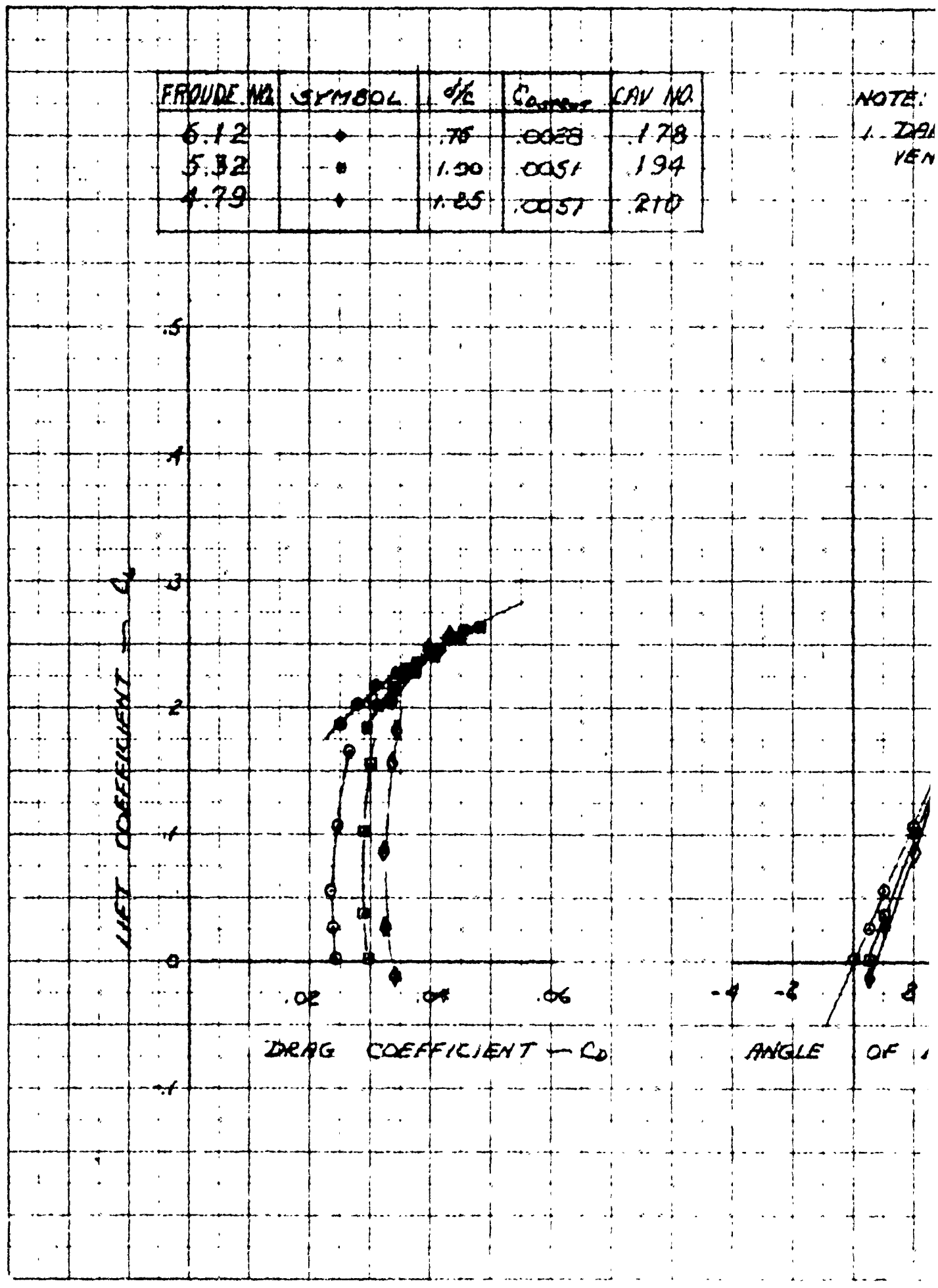


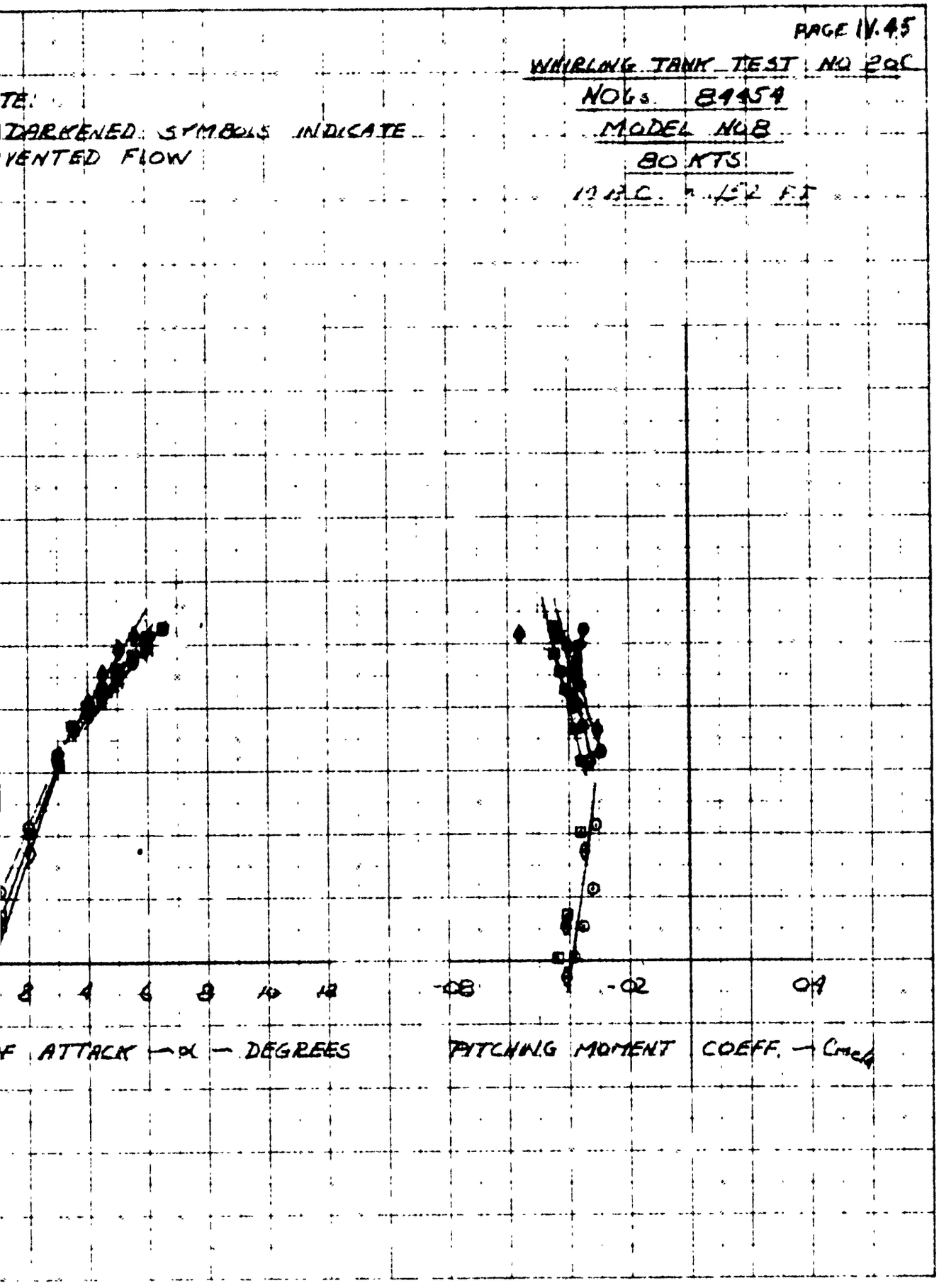
E ATTACK — α — DEGREES

PITCHING MOMENT COEFF — C_{m_q}

FROUDE NO.	SYMBOL	d/L	$C_{D_{min}}$	CAV NO.
6.12	◆	.75	.0028	.178
5.32	●	1.00	.0051	.194
4.79	♦	1.25	.0057	.210

NOTE:
1. ZAI
VEN



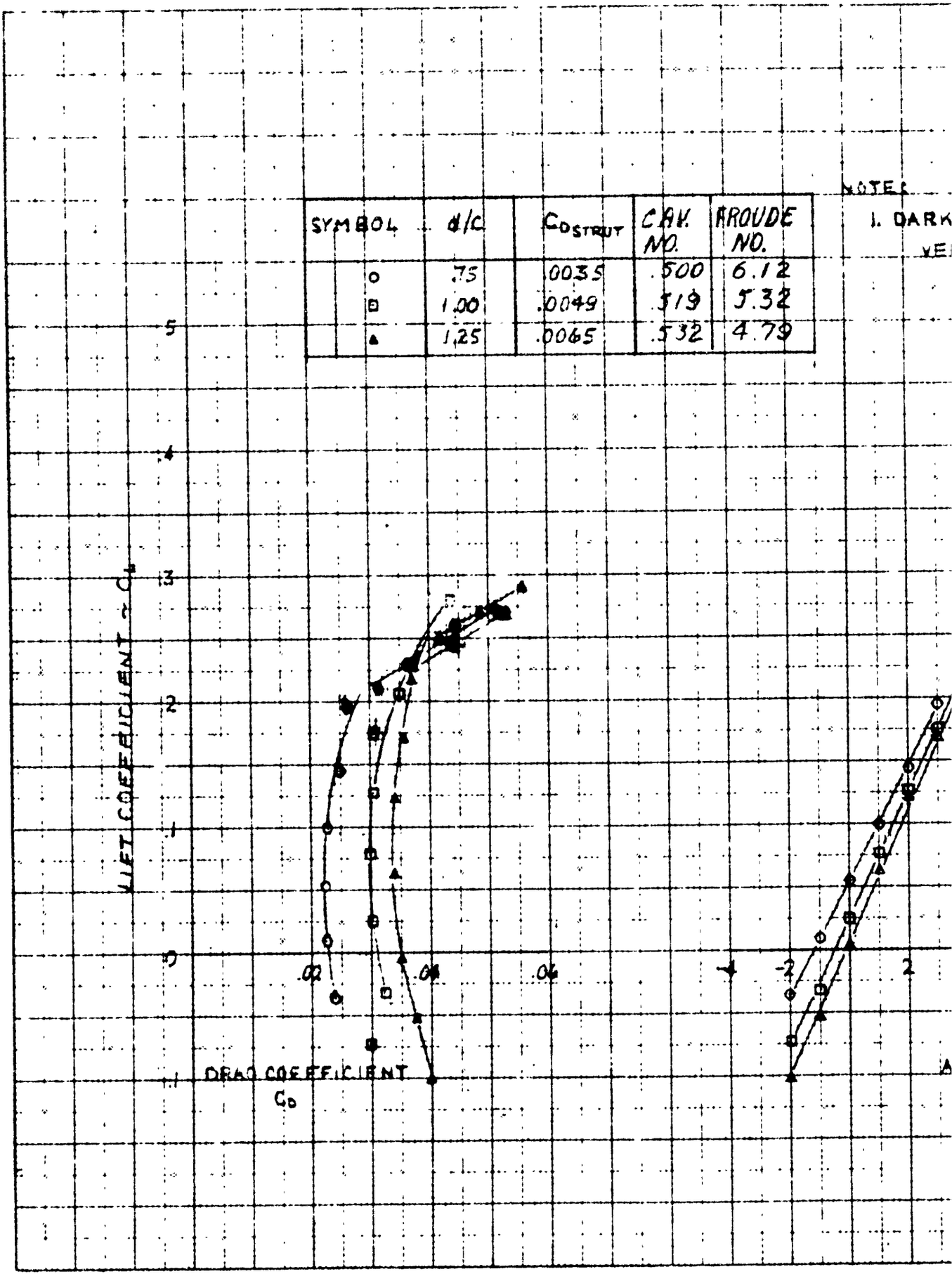

PAGE IV.45
WHIRLING TANK TEST NO 20C
NOGs. 84454
MODEL NO 8
80 KTS
TE:
DARKENED SYMBOLS INDICATE
VENTED FLOW
8
4
6
8
10
12
-08
-02
04
F ATTACK — α — DEGREES
PITCHING MOMENT COEFF. — Cmc/4

SYMBOL	d/c	$C_{D_{STRUT}}$	CAV. NO.	FROUDE NO.
○	.75	.0035	.500	6.12
□	1.00	.0049	.519	5.32
△	1.25	.0065	.532	4.79

NOTES

1. DARK

VE

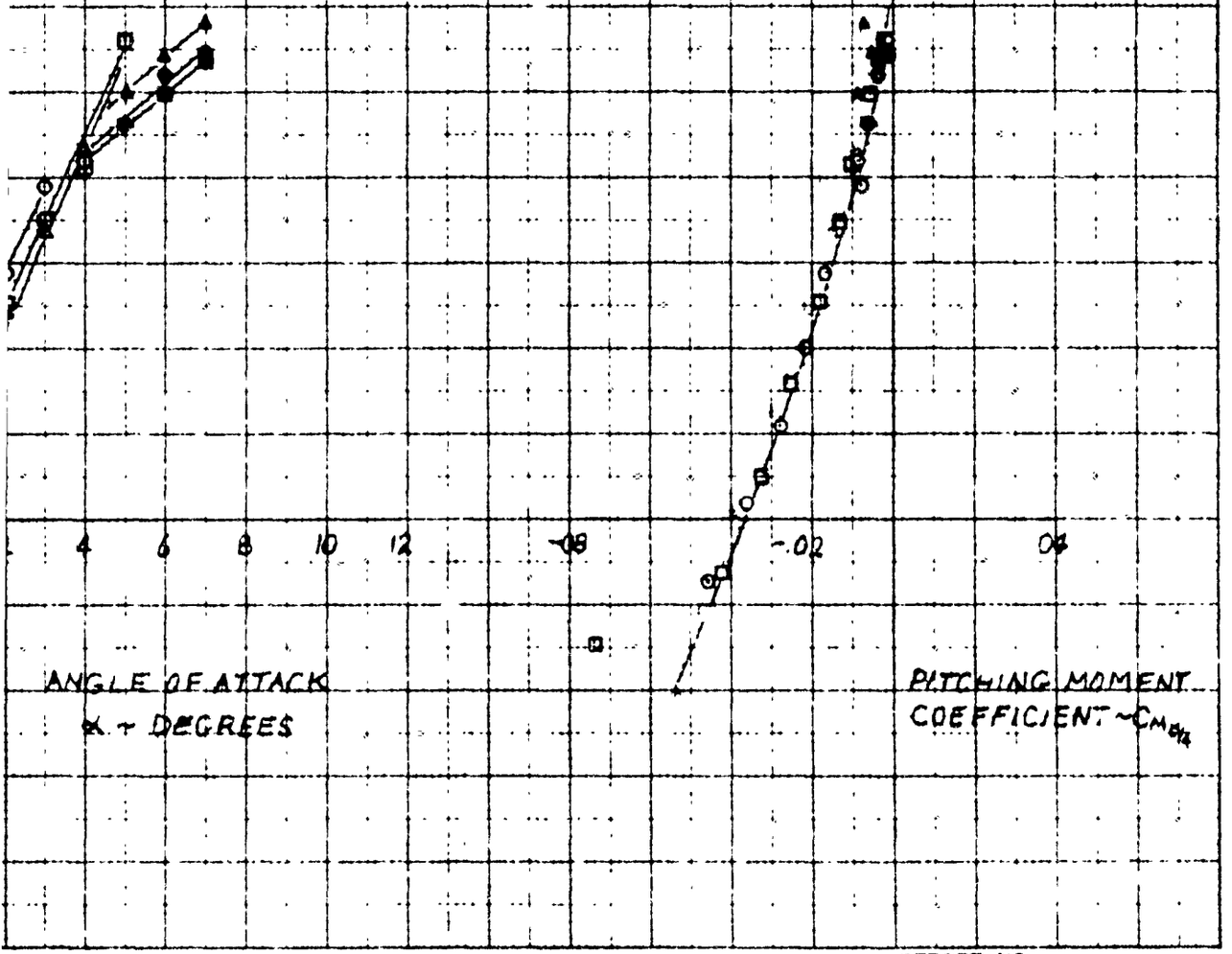


GRUMMAN AIRCRAFT ENGINEE

K-E

WHIRLING TANK TEST NO. 26E
NO. 65 89454
MODEL NO. 9
40 KTS
MAC = 1.56 FT.

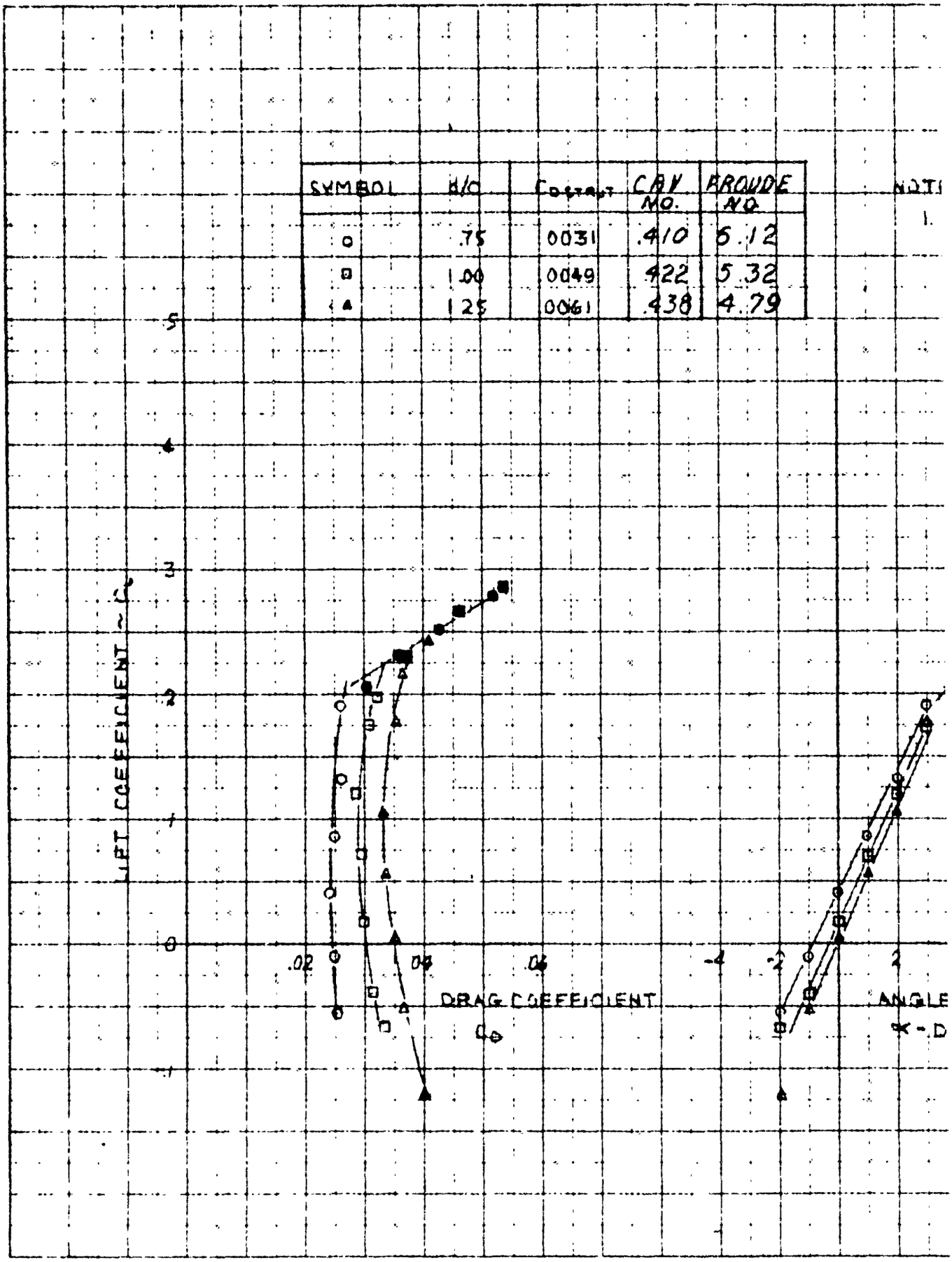
ARKENED SYMBOLS INDICATE
VENTED FLOW



ANGLE OF ATTACK
α - DEGREES

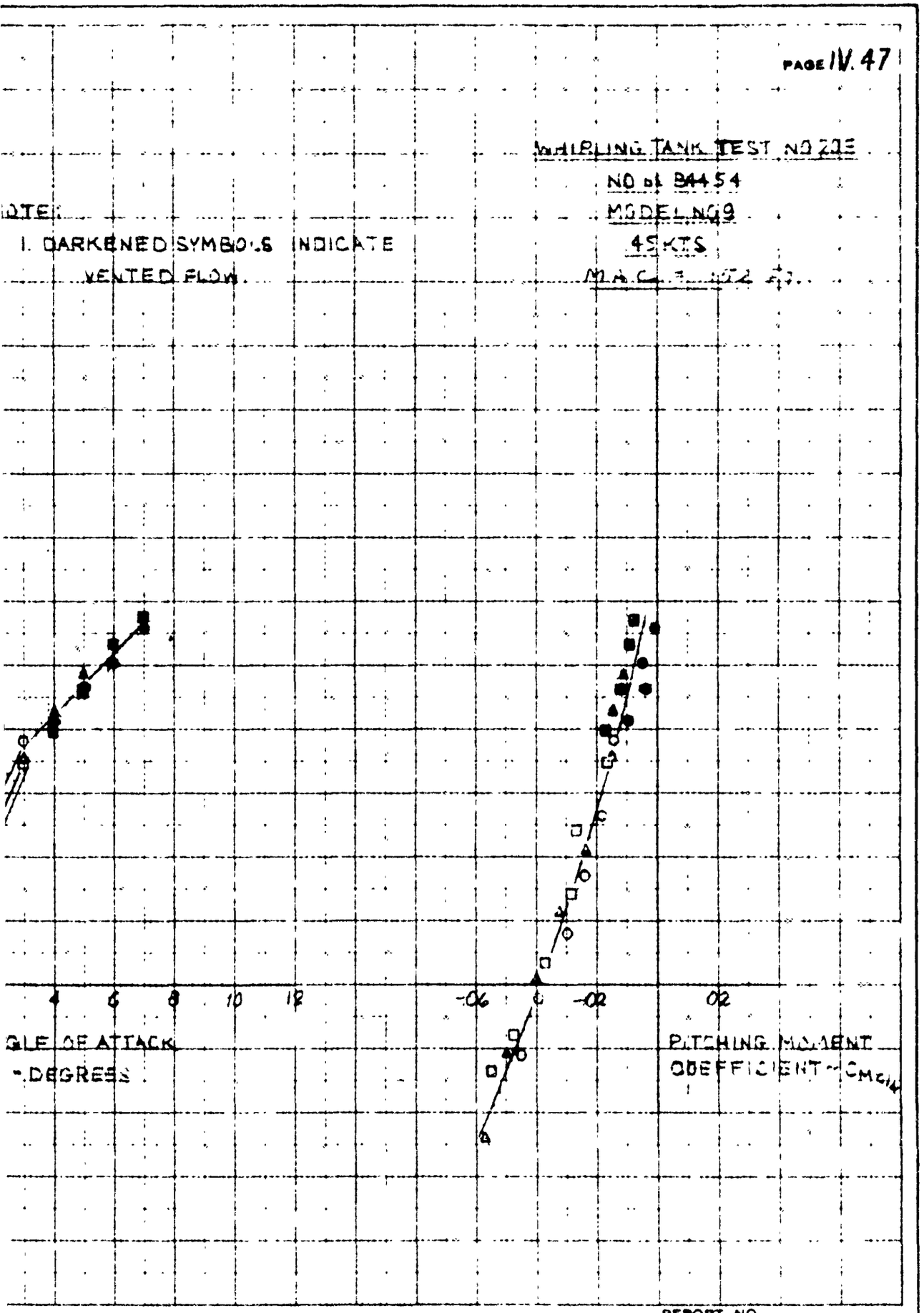
PITCHING MOMENT
COEFFICIENT - $C_{M_{c/4}}$

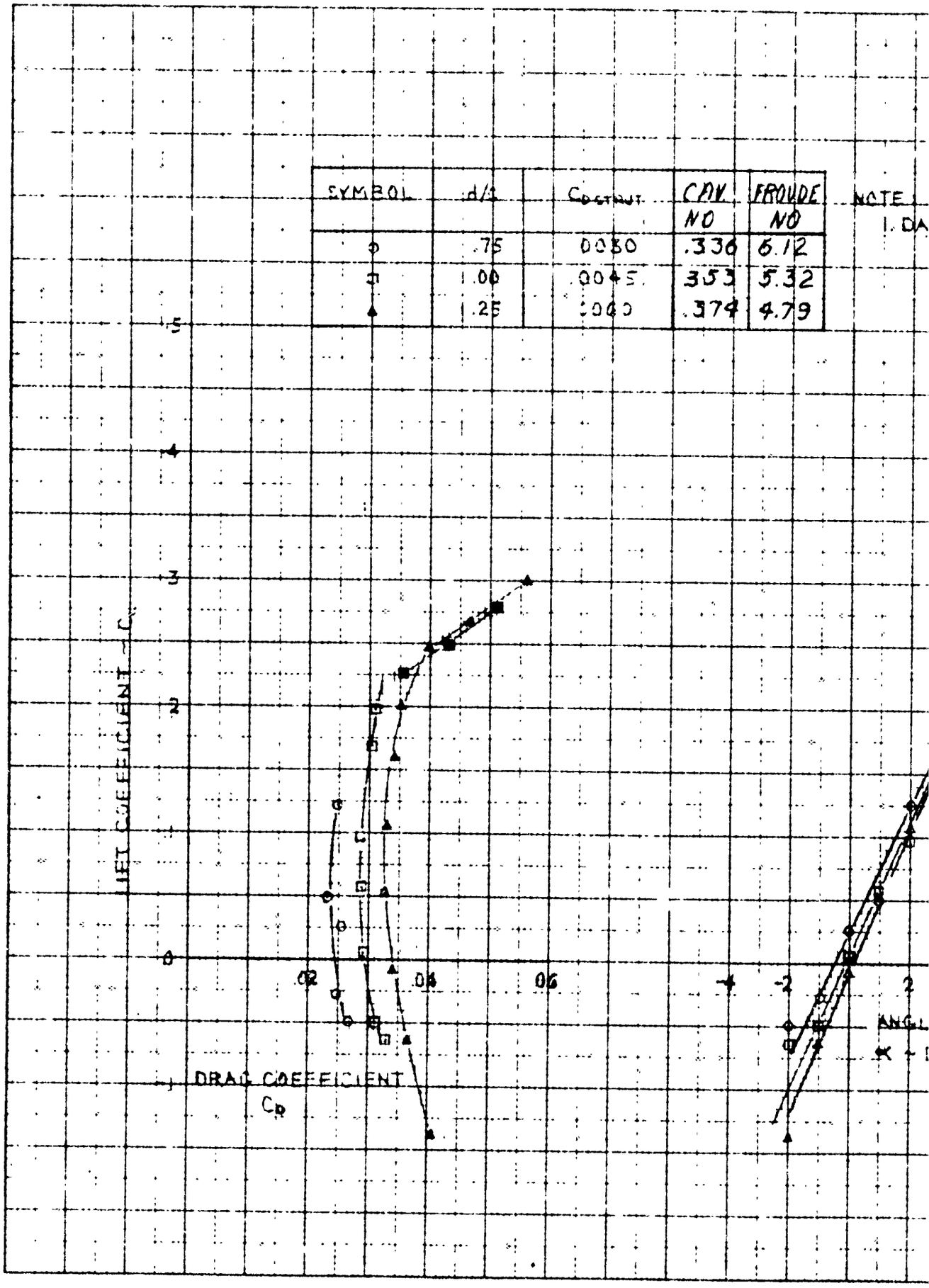
SYMBOL	H/C	Contour	CAV NO.	BROWDE NO.
o	.75	0031	.410	5.12
□	1.00	0049	.422	5.32
△	1.25	0061	.438	4.79



NOTI
1.

K-E

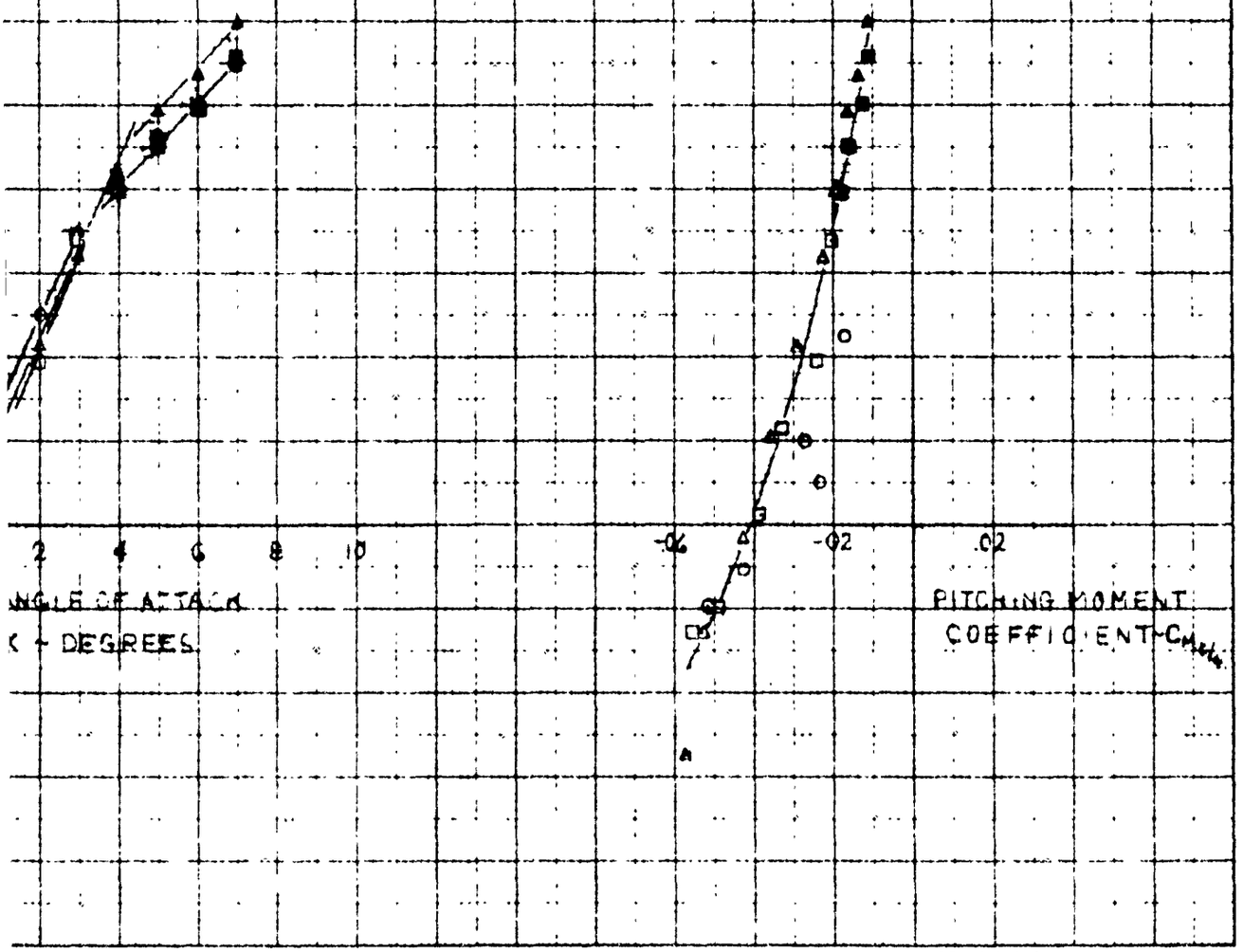

WHIRLING TANK TEST NO 20E
NO of B4454
MODEL NO 9
45 KTS
OTE:
1. DARKENED SYMBOLS INDICATE
VENTED FLOW.
4
6
8
10
12
-06
0
-02
02
GLE OF ATTACK
- DEGREES
PITCHING MOMENT
COEFFICIENT ~ $C_{M_{c/4}}$


SYMBOL
d/t
$C_{D\,STRUT}$
CAV NO
FROUDE NO
.75
.0030
.336
6.12
1.00
.0045
.353
5.32
1.25
.0060
.374
4.79
NOTE
1. DA
LIFT COEFFICIENT - C_L
DRAG COEFFICIENT
C_D
.02
.04
.06
-4
-2
2
ANGL
α

K-E

WHIRLING TANK TEST NO 21E
NO 6s B44E4
MODEL NO 9
50 KTS
M.A.C. 1.152 FT

TE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW

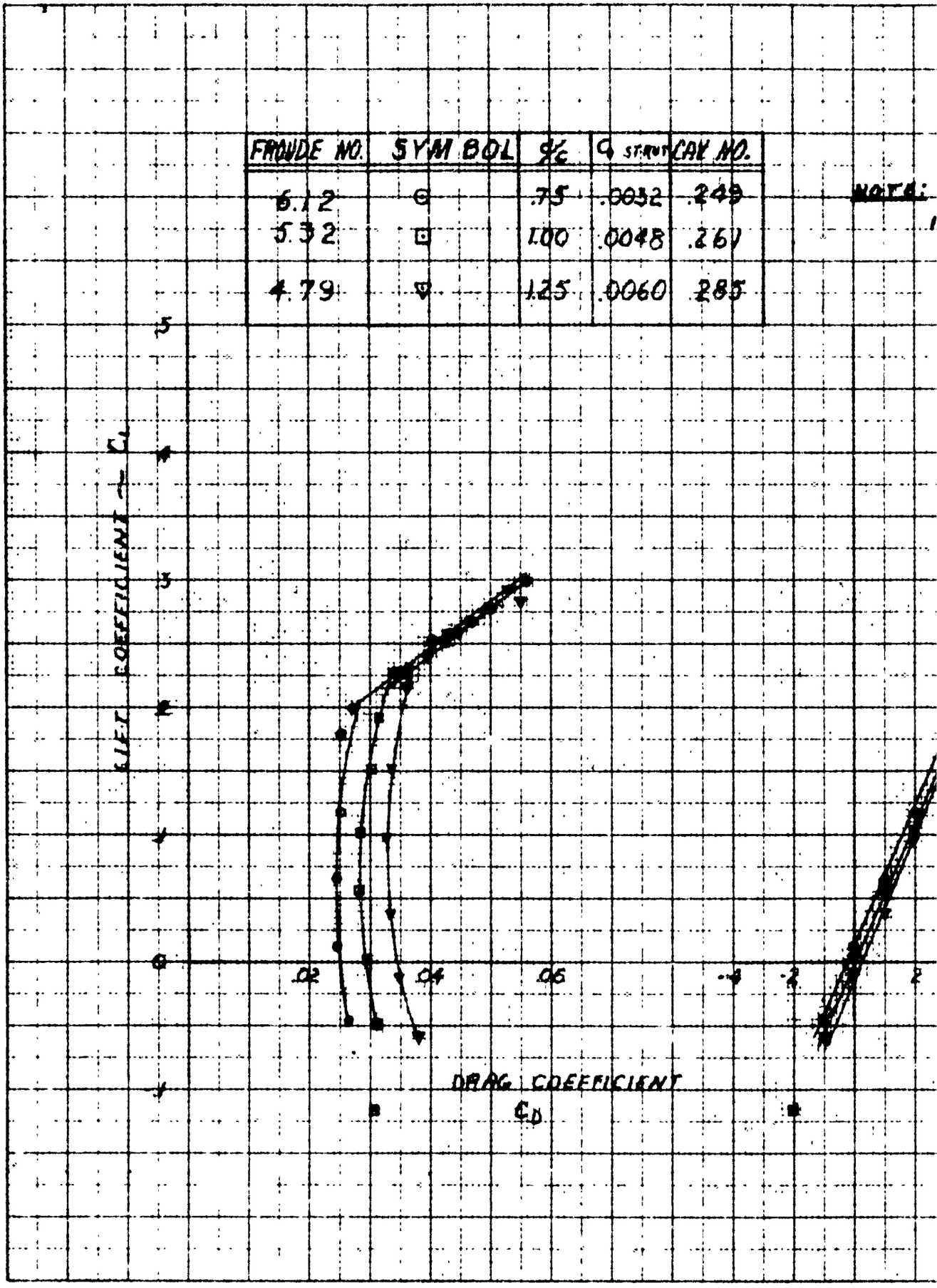


NGLE OF ATTACK
K - DEGREES

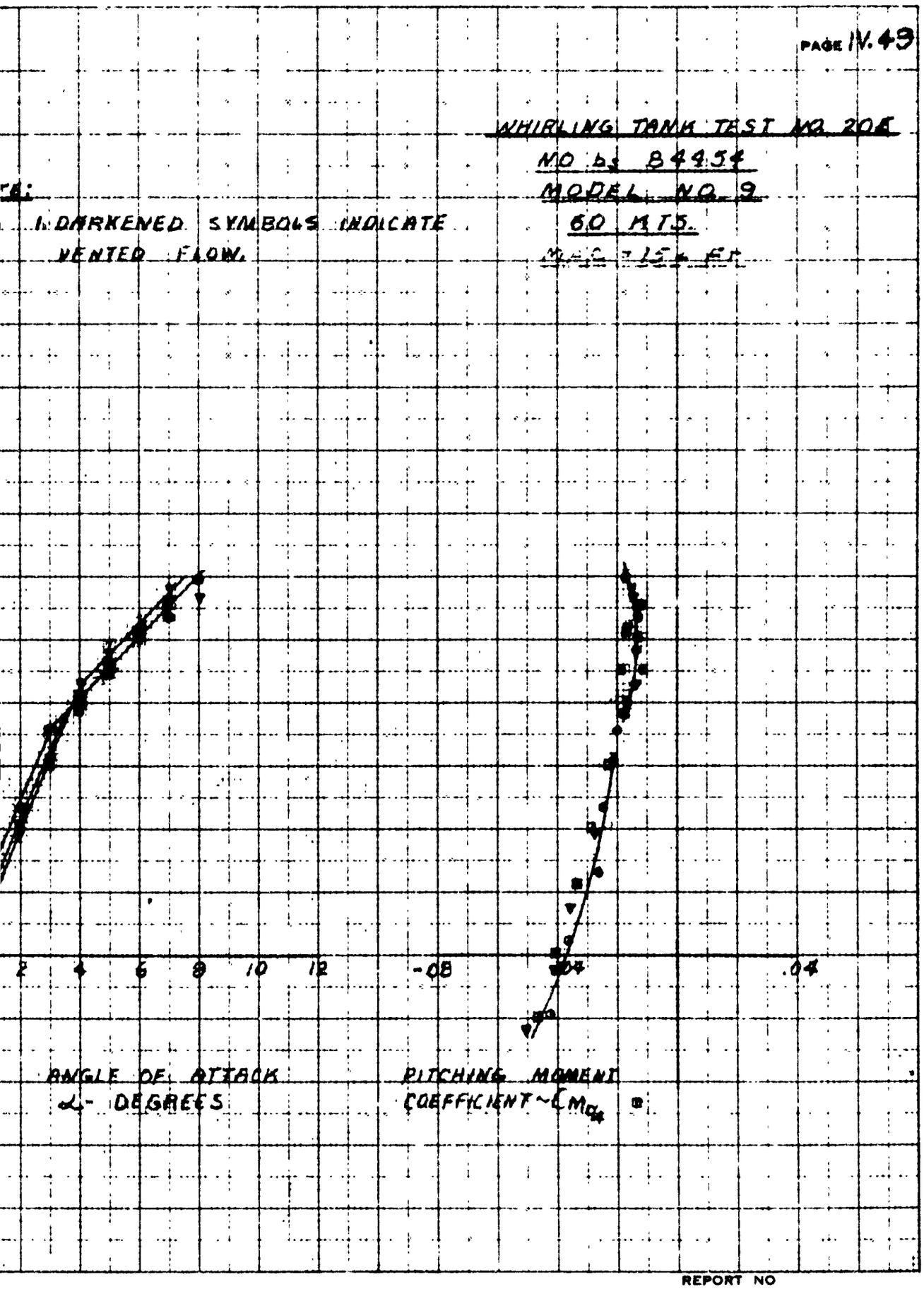
PITCHING MOMENT
COEFFICIENT - $C_{M_{c/4}}$

FROUDE NO.	SYMBOL	ℓ/c	σ strut	CAV NO.
6.12	○	.75	.0032	.249
5.32	□	1.00	.0048	.261
4.79	▽	1.25	.0060	.285

NOTE:

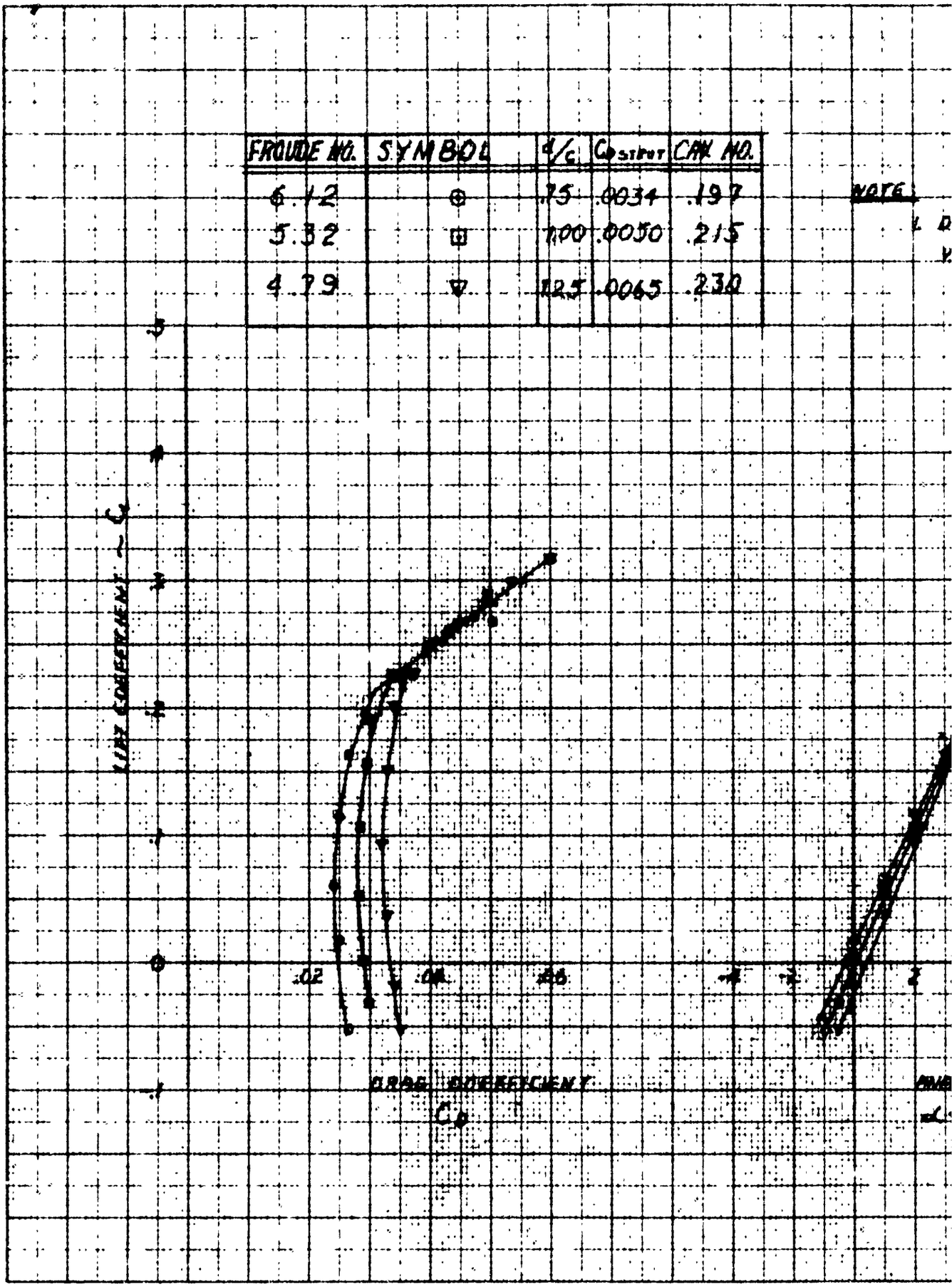


K+E ALBANENE 1967 00000

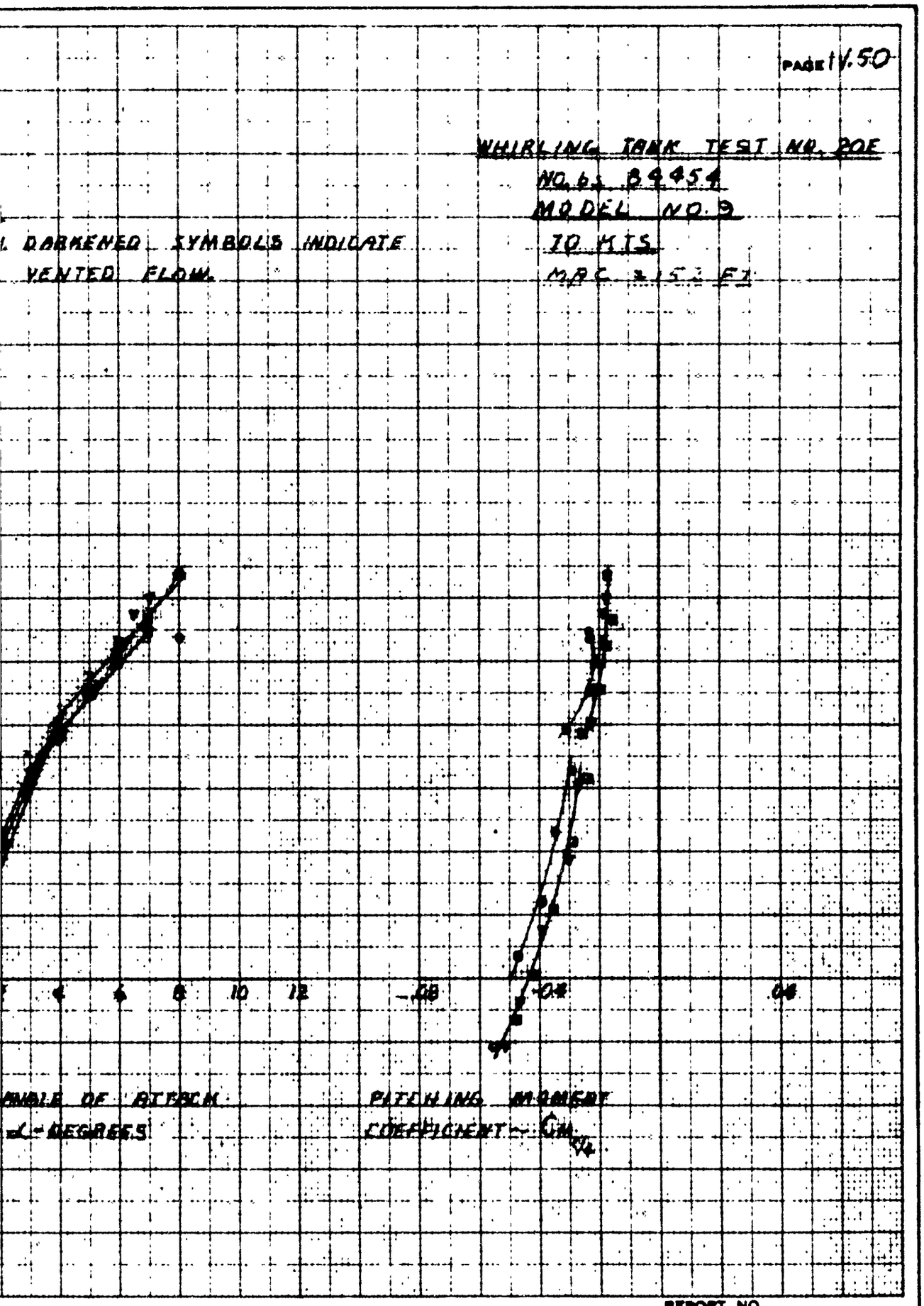

WHIRLING TANK TEST NO. 20E
NO bs 84454
MODEL NO. 9
60 KTS.
TE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.
2
4
6
8
10
12
-.08
.04
ANGLE OF ATTACK
α - DEGREES
PITCHING MOMENT
COEFFICIENT ~ $C_{M_{\alpha_4}}$

FROUDE NO.	SYMBOL	d/c	$C_{D_{STRUT}}$	CAV NO.
6.12	⊕	.75	.0034	.197
5.32	⊞	1.00	.0050	.215
4.79	▽	1.25	.0065	.230

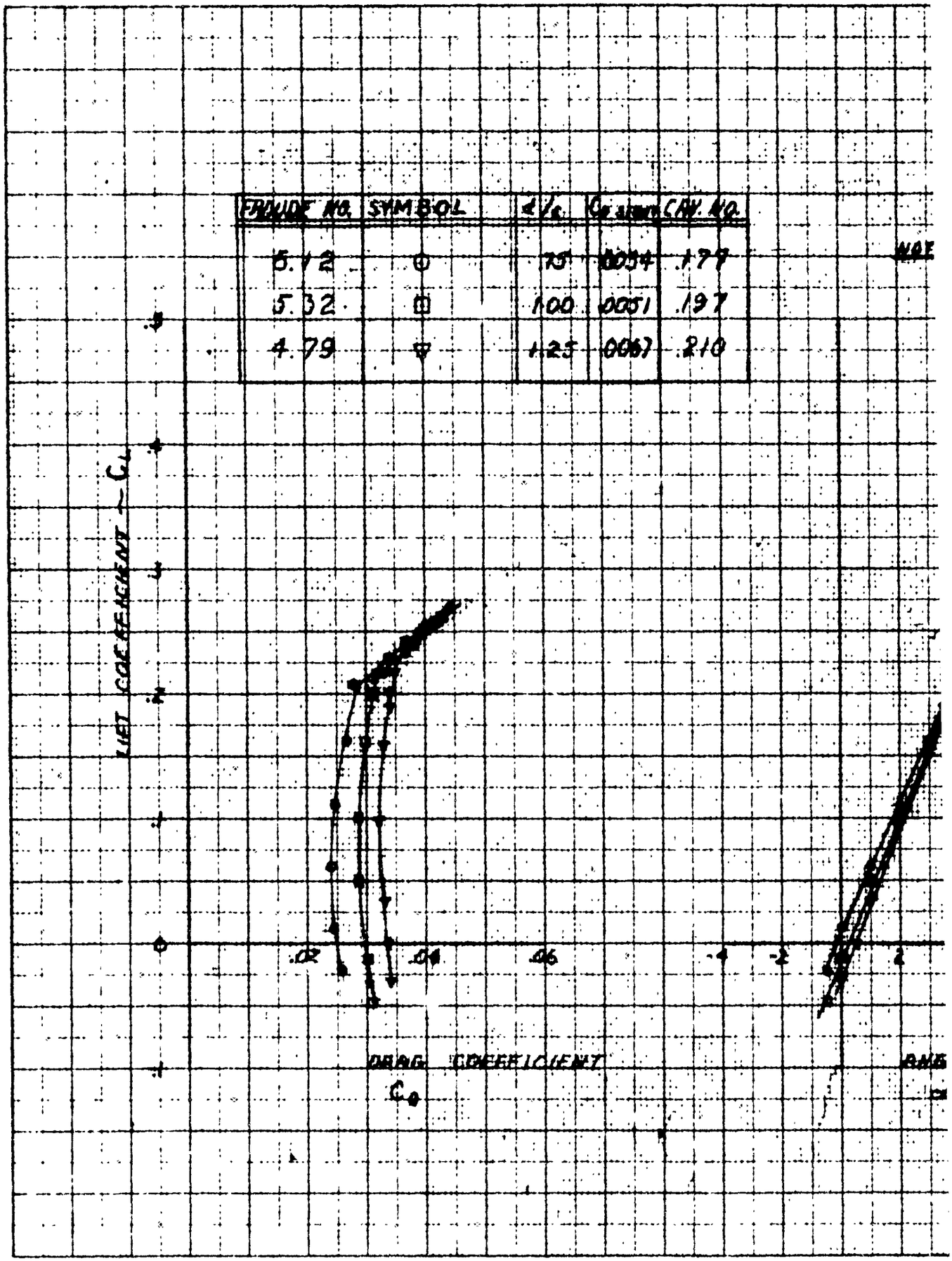
NOTE

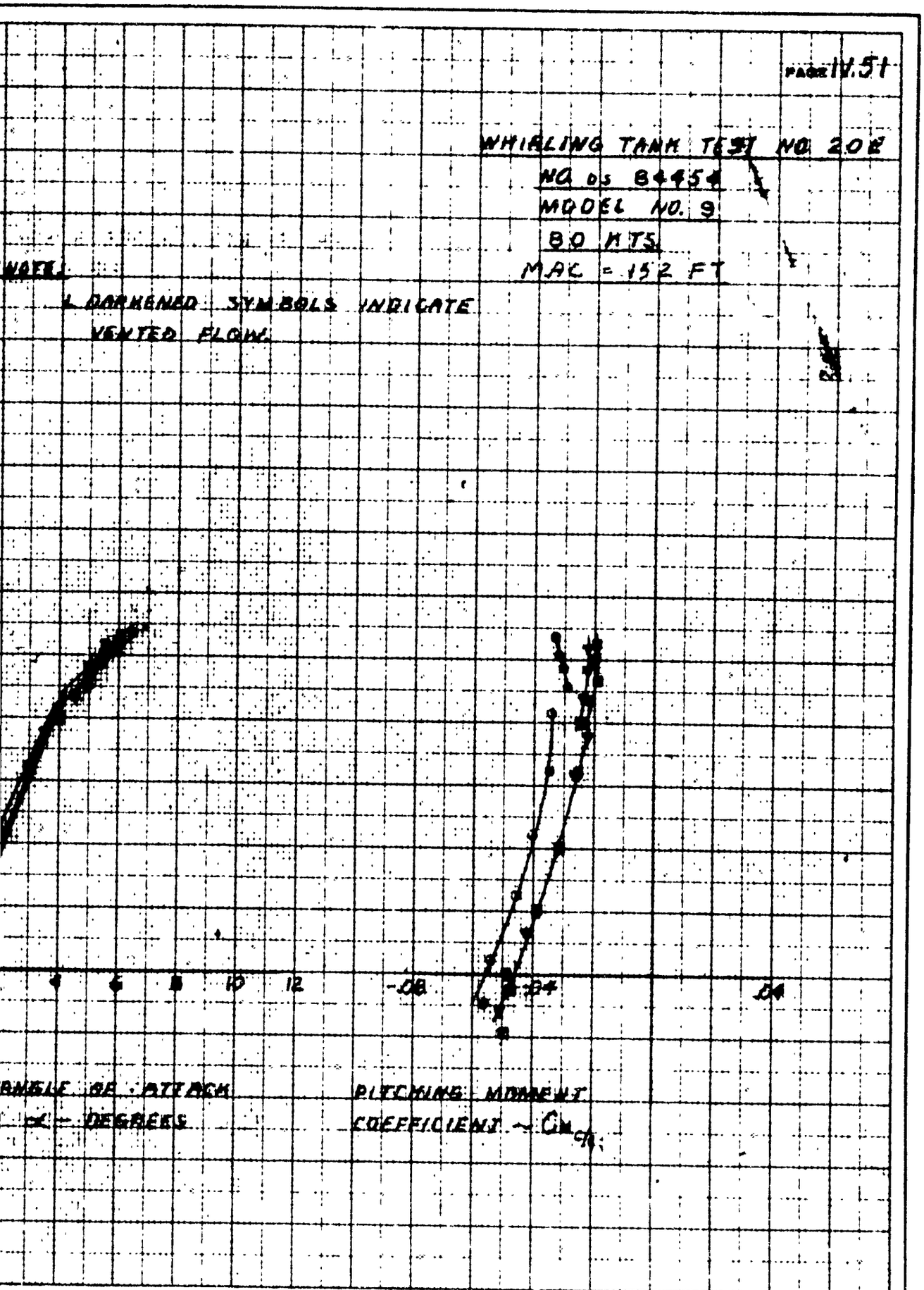


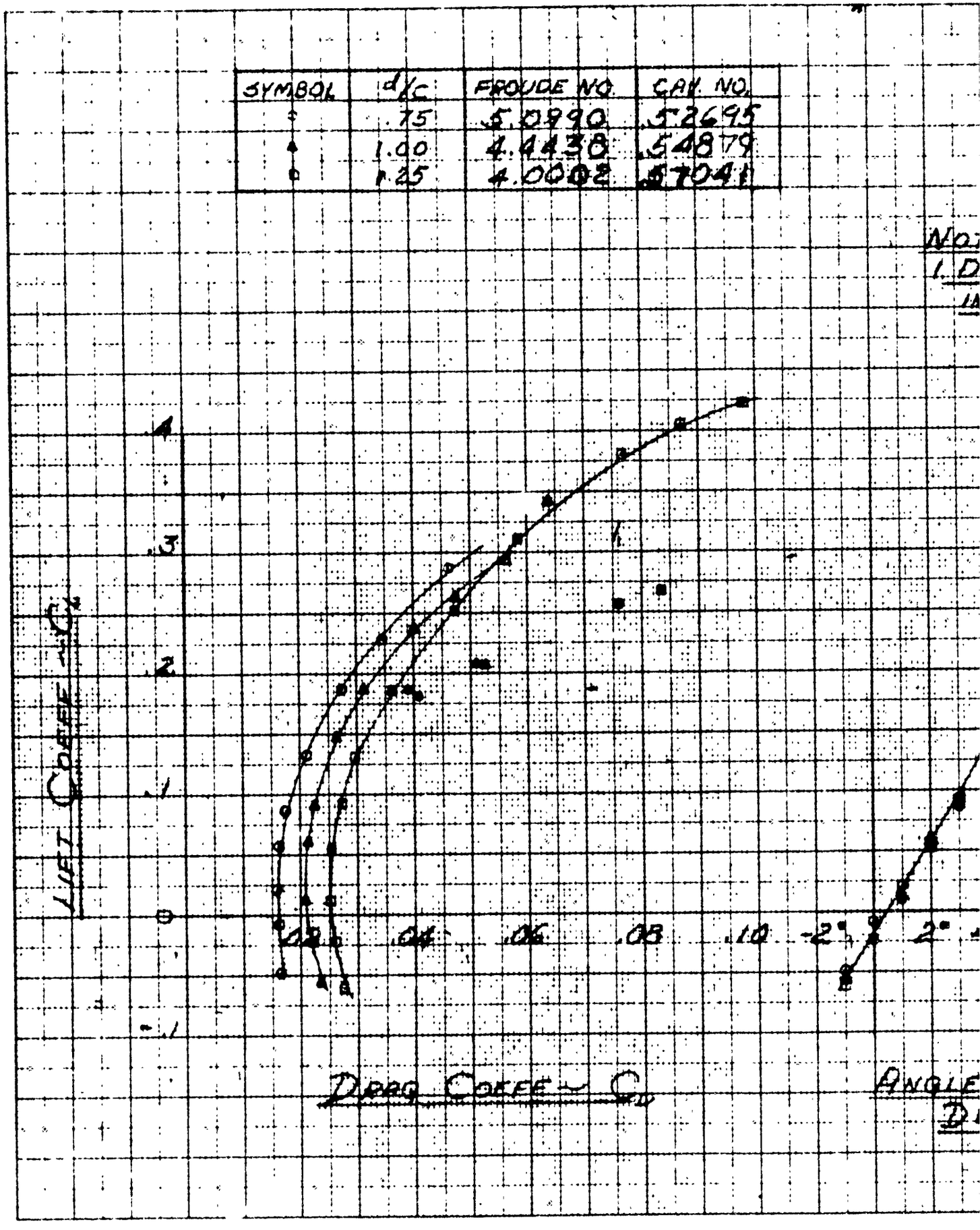
K+E


PAGE IV.50
WHIRLING TANK TEST NO. 20E
NO. 6s 84454
MODEL NO. 9
70 KTS.
MAC = 152 FT
DARKENED SYMBOLS INDICATE
VENTED FLOW.
4
6
8
10
12
-.08
-.04
.04
ANGLE OF ATTACK
α - DEGREES
PITCHING MOMENT
COEFFICIENT ~ $C_{M_{c/4}}$

REPORT NO

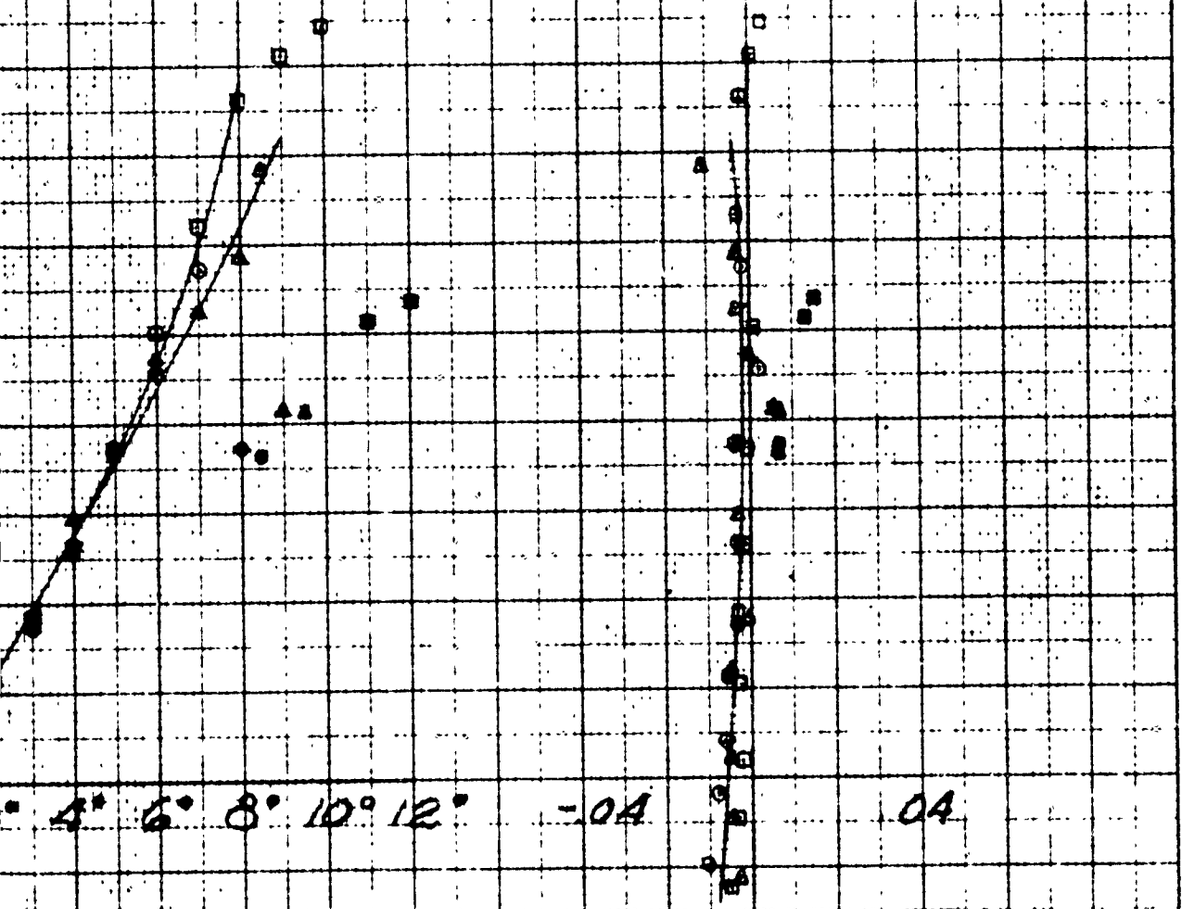

FROUDE NO.
SYMBOL
5.12
5.32
4.79
LIFT COEFFICIENT C_L
DRAG COEFFICIENT
C_D
.02
.04
.06
-4
-2


WHIRLING TANK TEST NO 20E
NO DS 84454
MODEL NO. 9
80 KTS
MAC = 152 FT
NOTE:
DARKENED SYMBOLS INDICATE
VENTED FLOW.
4
6
8
10
12
-.08
-.04
.04
ANGLE OF ATTACK
α - DEGREES
PITCHING MOMENT
COEFFICIENT ~ $C_{M_{c/4}}$


SYMBOL
d/c
FROUDE NO.
CAV. NO.
.75
5.0990
.52695
1.00
4.4438
.54879
1.25
4.0002
.57041
LIFT COEFF. - C_L
DRAG COEFF. - C_D
.04
.06
.08
.10
-2°
2°

WHIDLING TANK TEST NO. 39
BUSHIPS FOIL NO. 10
M.A.C. = .222 FT. - AREA = 8 sq in
V = 40 KNOTS

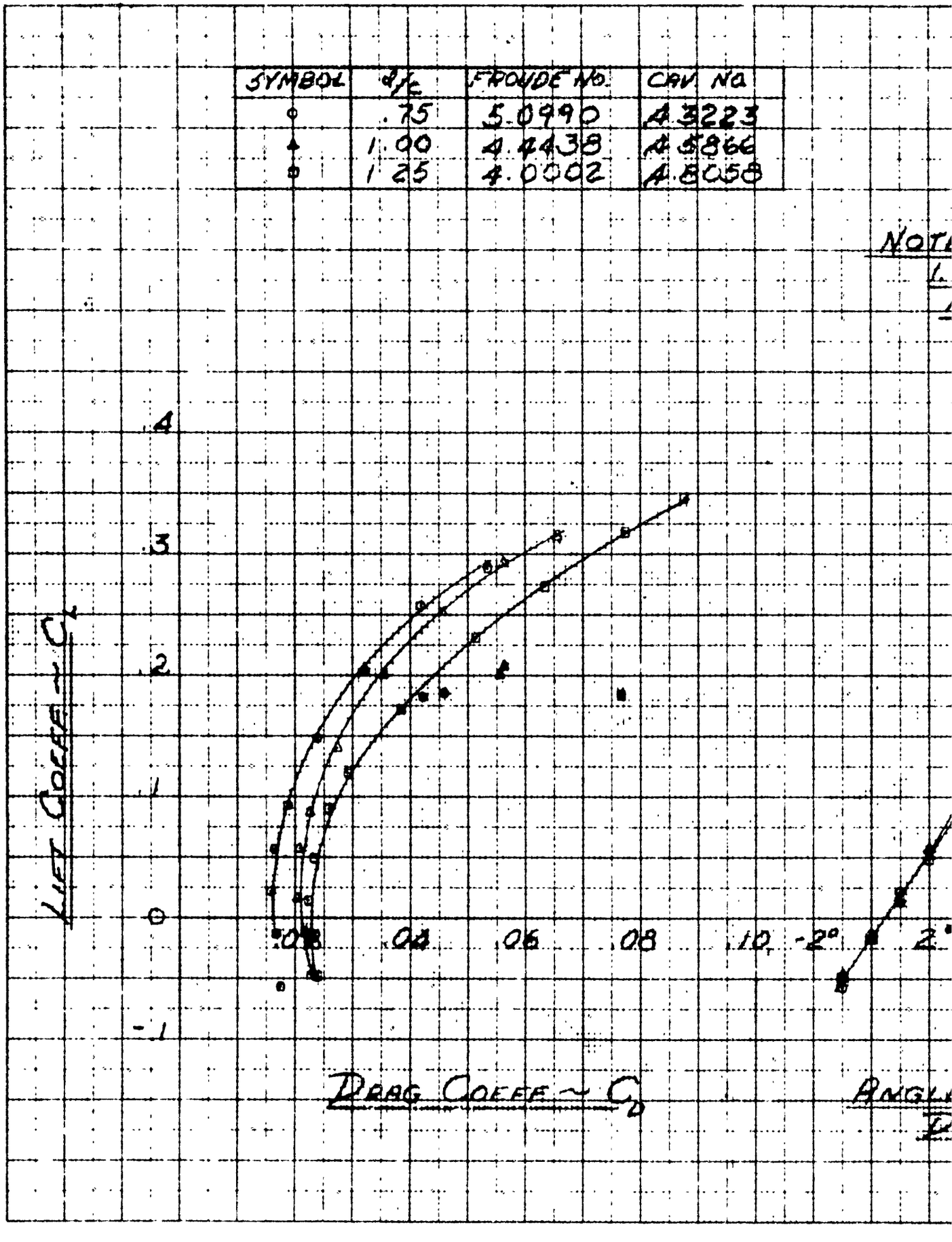
NOTE:
DARKENED SYMBOLS
INDICATE VENTED FLOW



LE OF ATTACK
DEGREES

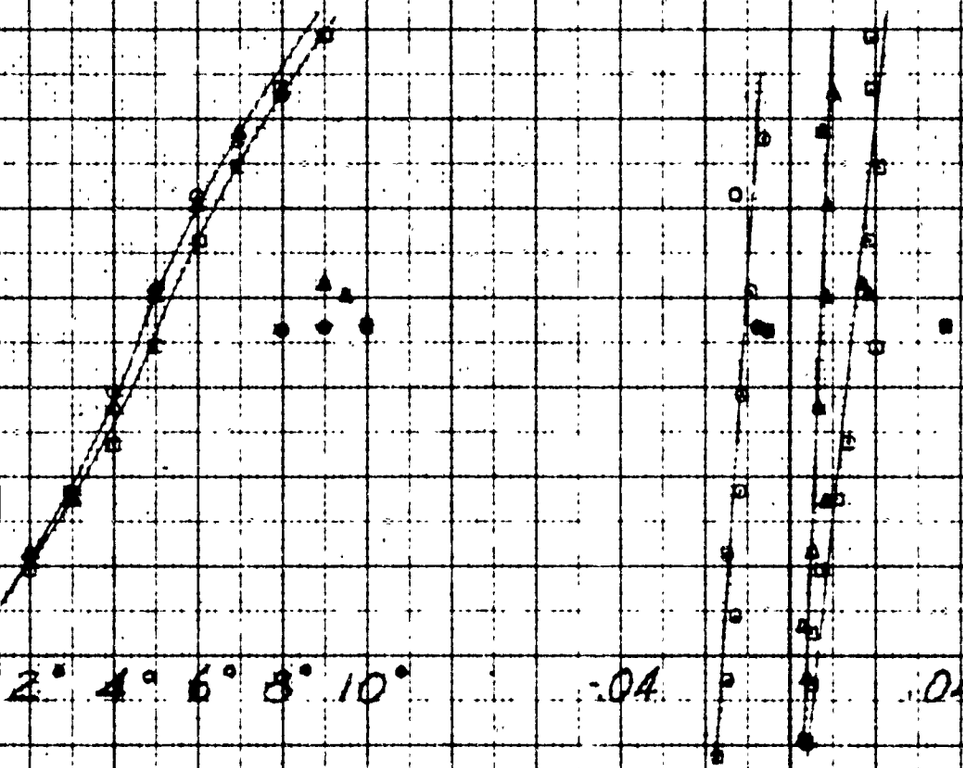
PITCHING MOMENT
COEFF. - $C_{M_{c/4}}$

SYMBOL	d/L	FROUDE NO.	CAV NO
○	.75	5.0990	A 3223
▲	1.00	4.4438	A 5866
⊙	1.25	4.0002	A 8058



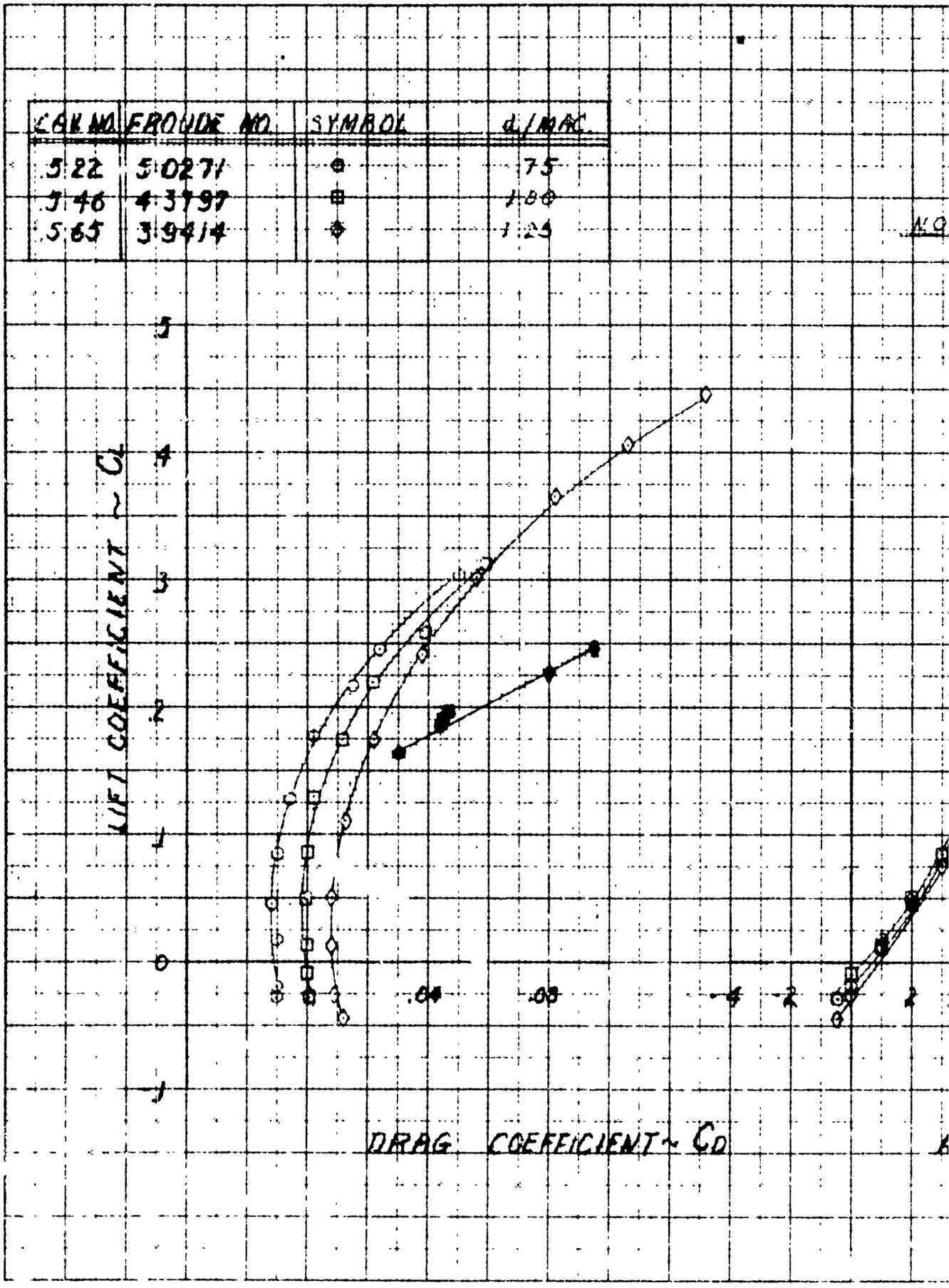
WHIRLING TANK TEST NO. 35
BUSHIPS FOIL NO. 10
M.A.C. = 2.22 FT. - AREA = 8.9 "
V = 45 KNOTS

OTE:
1. DARKENED SYMBOLS
INDICATE VENTED FLOW.



GLE OF ATTACK
DEGREES

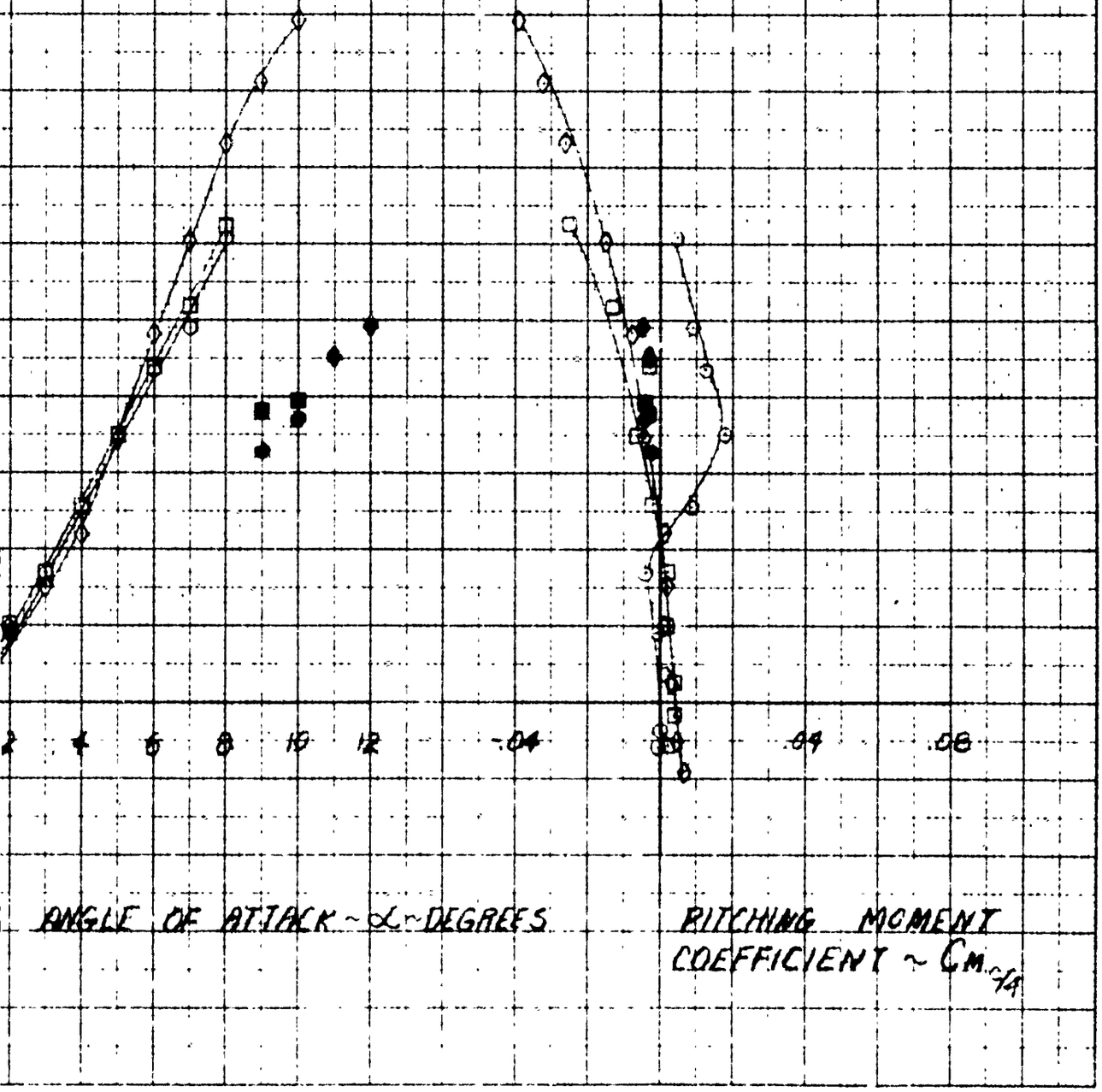
PITCHING MOMENT
COEFF. - $C_{m_{c/4}}$


CAL NO
FROUDE NO
SYMBOL
d/MAC
5.22
5.0271
.75
7.46
4.3797
1.00
5.65
3.9414
1.25
LIFT COEFFICIENT ~ CL
DRAG COEFFICIENT ~ CD
5
4
3
2
1
0
-1
.04
.08

WHIRLING TANK TEST NO 40
FOIL NO.11 MAC. = 0229 FT.
AREA = 9.60 SQ.IN.

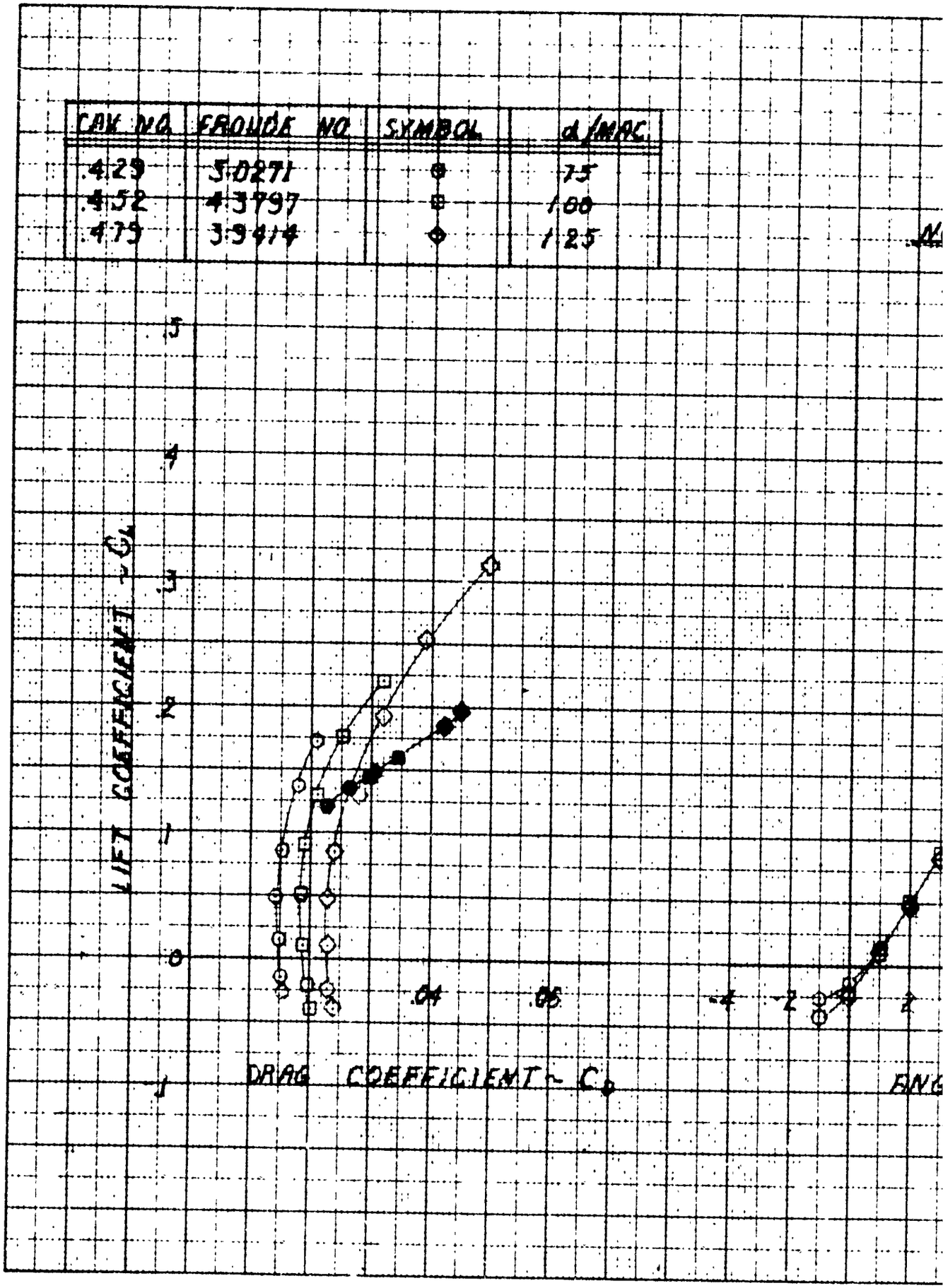
V = 40 KTS.

NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW



ANGLE OF ATTACK ~ α ~ DEGREES

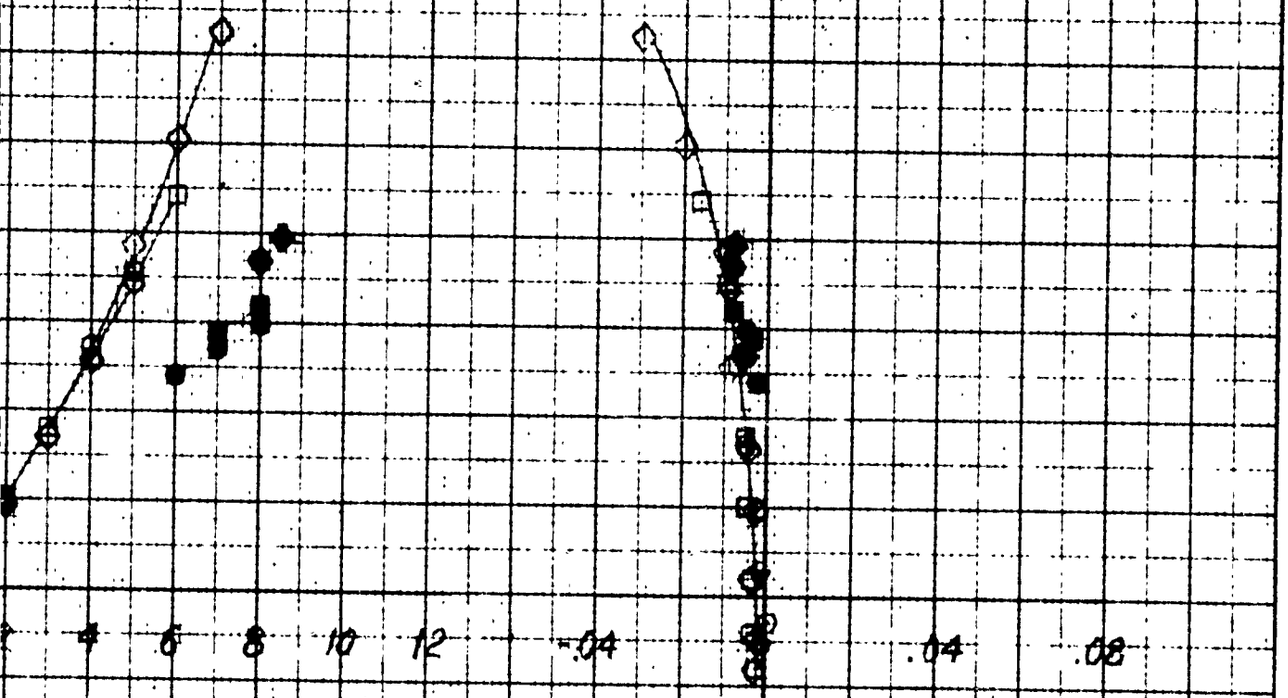
PITCHING MOMENT COEFFICIENT ~ $C_{M_{c/4}}$


CAV NO.
FROUDE NO.
SYMBOL
d/MAC
.429
5.0271
.75
.452
4.3797
1.00
.479
3.9414
1.25
LIFT COEFFICIENT - C_L
.5
.4
.3
.2
.1
0
-.1
.04
.05
-4
-2
2
DRAG COEFFICIENT - C_D

WHIRLING TANK TEST NO. 40.
FOIL NO 11 MAC = 0.229 FT.
AREA = 9.60 SQ. IN.

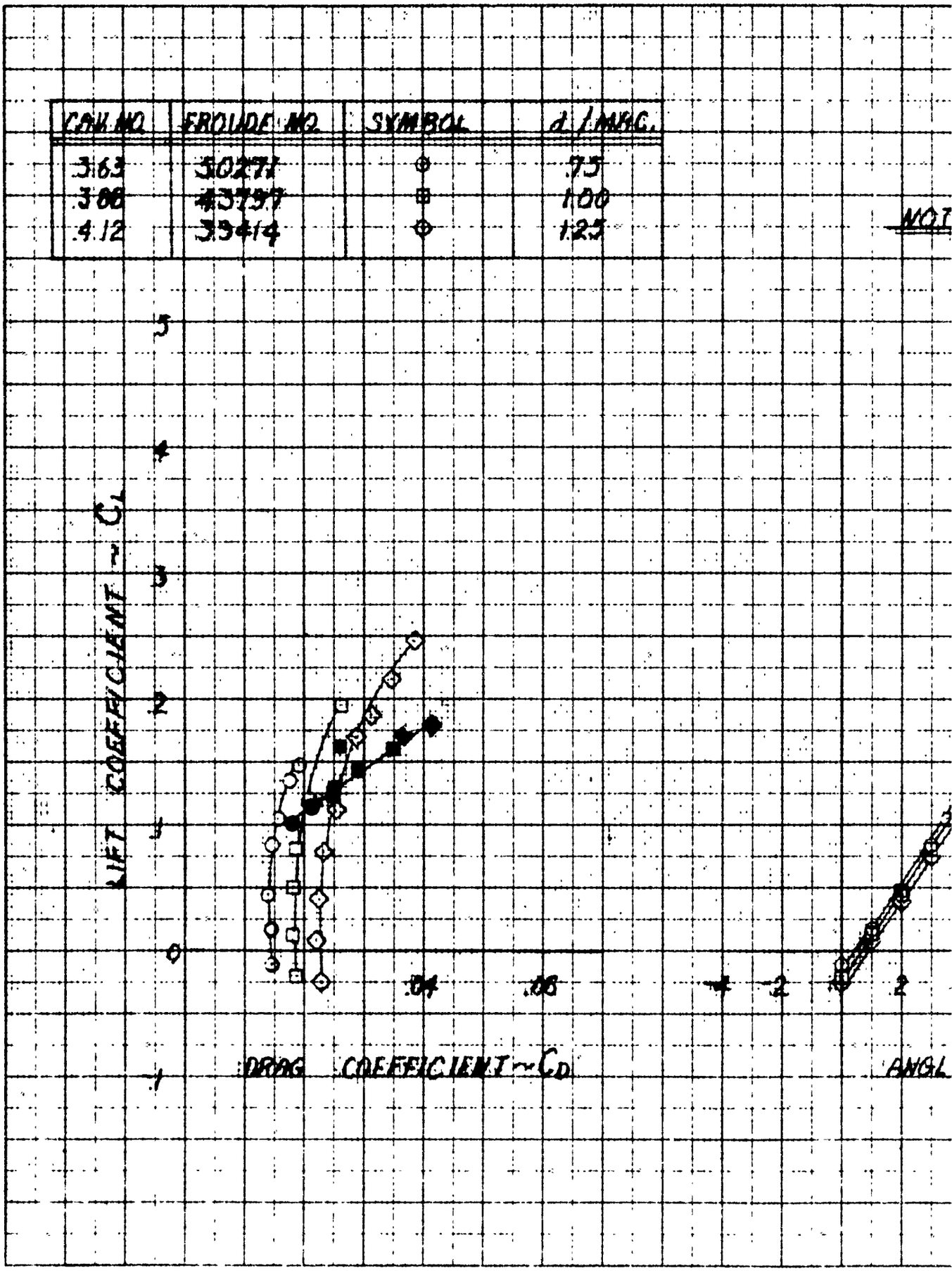
V = 45 KTS

NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



ANGLE OF ATTACK - α - DEGREES

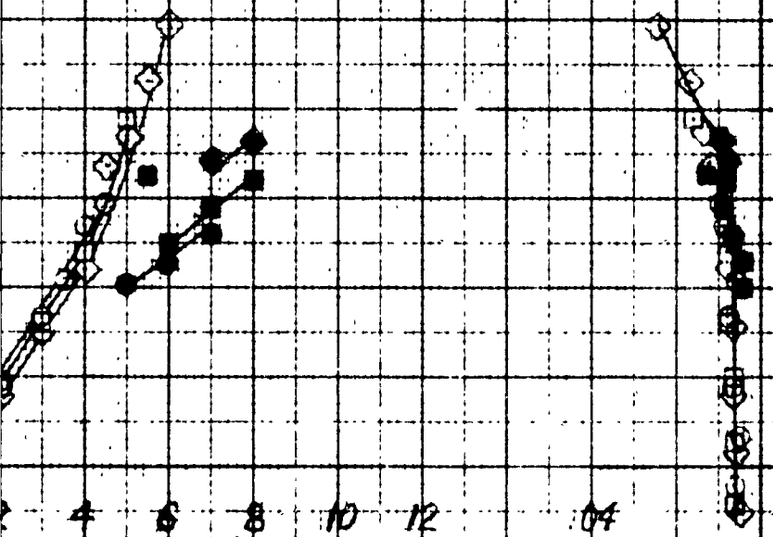
PITCHING MOMENT COEFFICIENT - $C_{M_{C/4}}$


CAM NO.
EROLADE NO.
SYMBOL
d / MAC.
.363
50271
.75
.388
43797
1.00
.412
33414
1.25
MOT
LIFT COEFFICIENT - C_L
5
4
3
2
1
0
.04
.06
DRAG COEFFICIENT - C_D
-4
-2
2
ANGL

WHIRLING TANK TEST NO. 40
FOIL NO. 11 MAC. = 0.229 FT.
AREA = 9.60 SQ. IN.

V = 50 KTS.

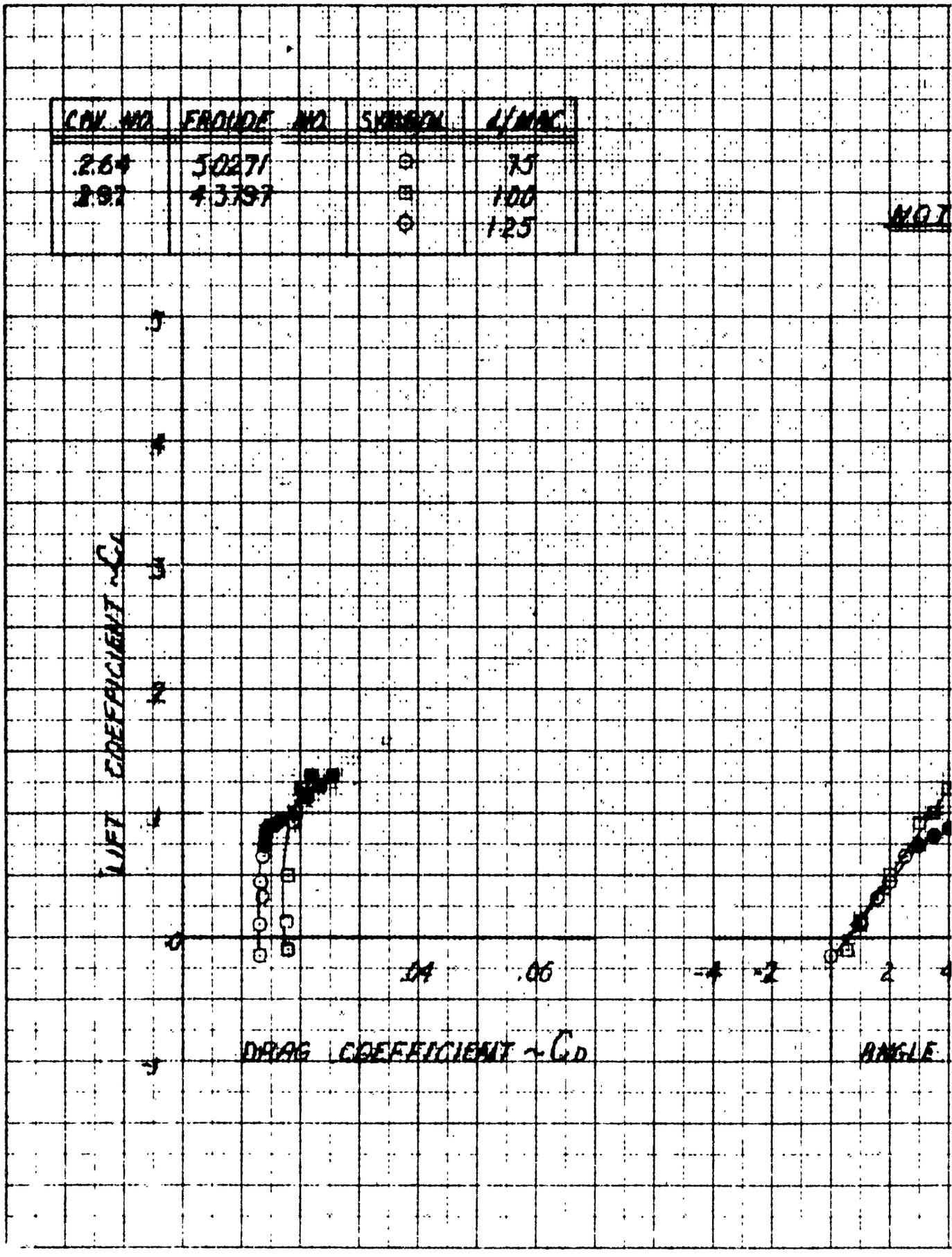
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



4 6 8 10 12 .04 .04 .08

ANGLE OF ATTACK ~ α ~ DEGREES

PITCHING MOMENT COEFFICIENT ~ $C_{M_{c/4}}$

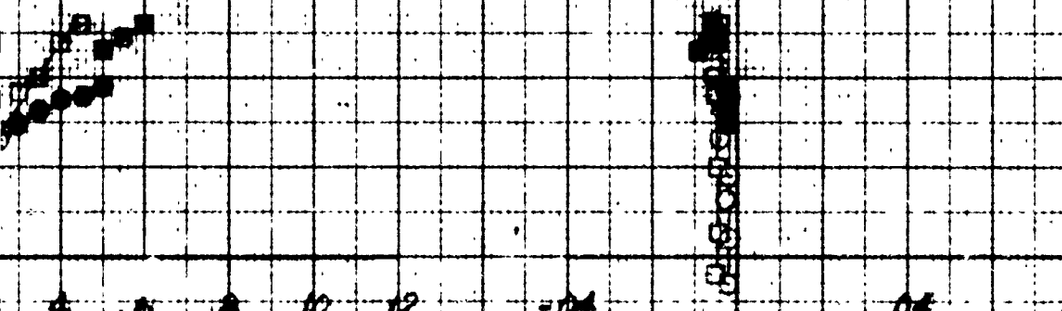


CAV. NO.
FROUDE NO.
SYMBOL
d/MAC
2.64
50271
75
2.92
43797
100
125
NOT
LIFT COEFFICIENT ~ C_L
.5
.4
.3
.2
.1
0
-.1
.04
.06
-4
-2
2
4
DRAG COEFFICIENT ~ C_D
ANGLE

WHIRLING TANK TEST NO 40
FOIL NO 11 MAC = 0.229 FT
AREA = 9.60 SQ IN

V = 60 KTS

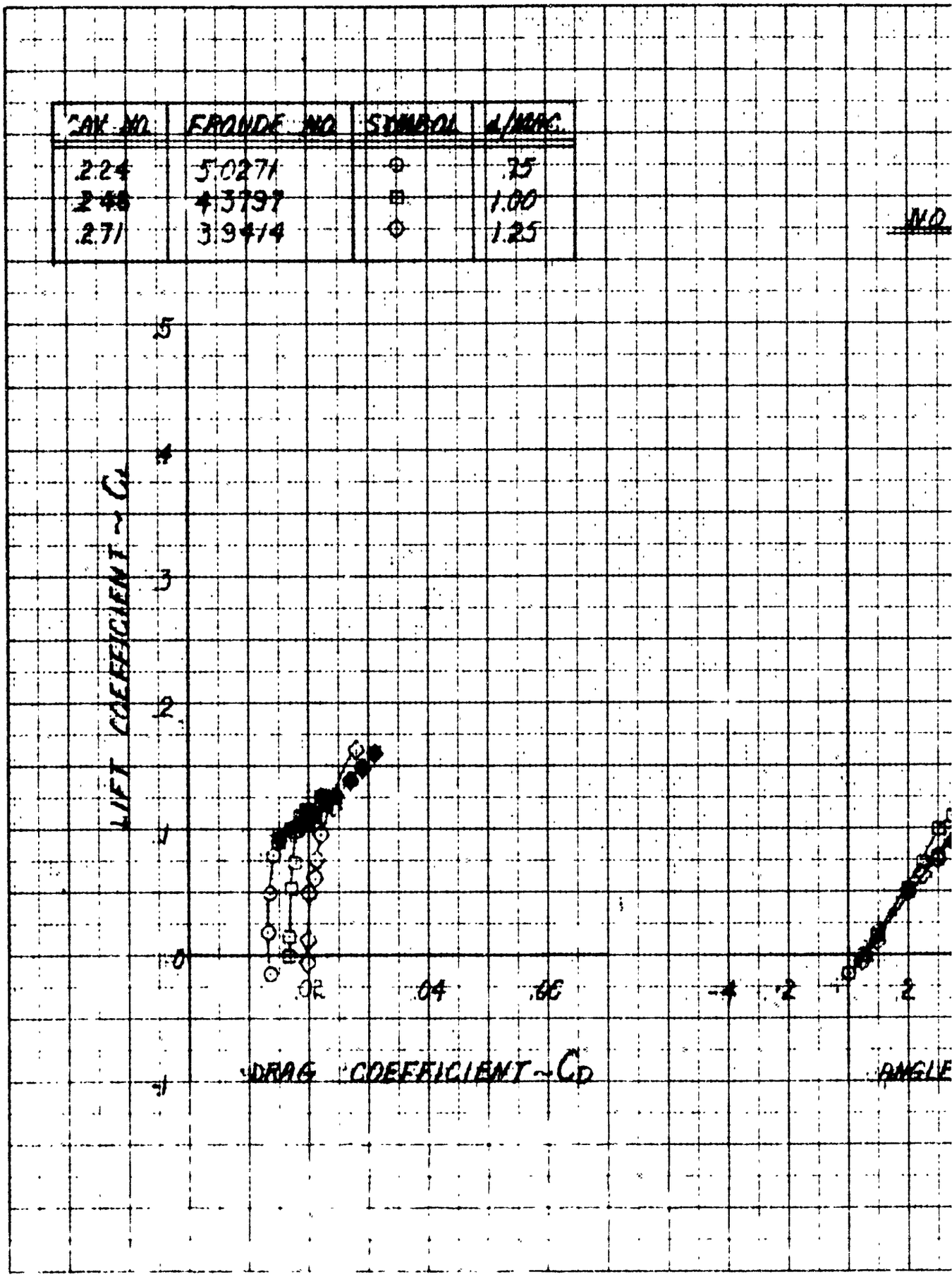
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



LE OF ATTACK - α - DEGREES

PITCHING MOMENT COEFFICIENT - $C_{M_{c/4}}$

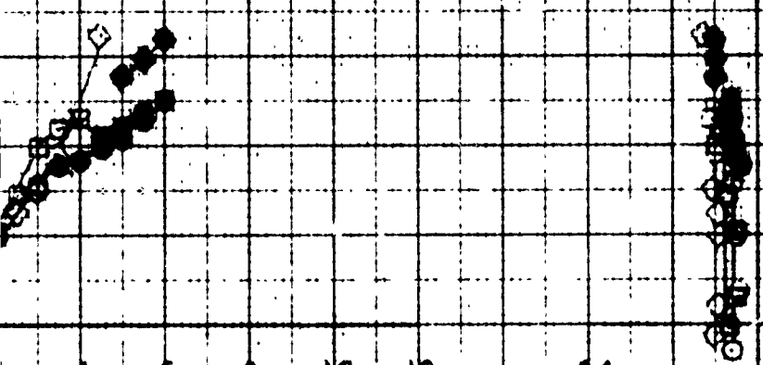
CAV NO.	FROUDE NO.	SYMBOL	d/MAC.
.224	5.0271	⊕	.25
.246	4.3797	⊞	1.00
.271	3.9414	⊕	1.25



WHIRLING TANK TEST NO. 40
FOIL NO 11 MAC = 0.229 FT.
AREA = 3.60 SQ. IN.

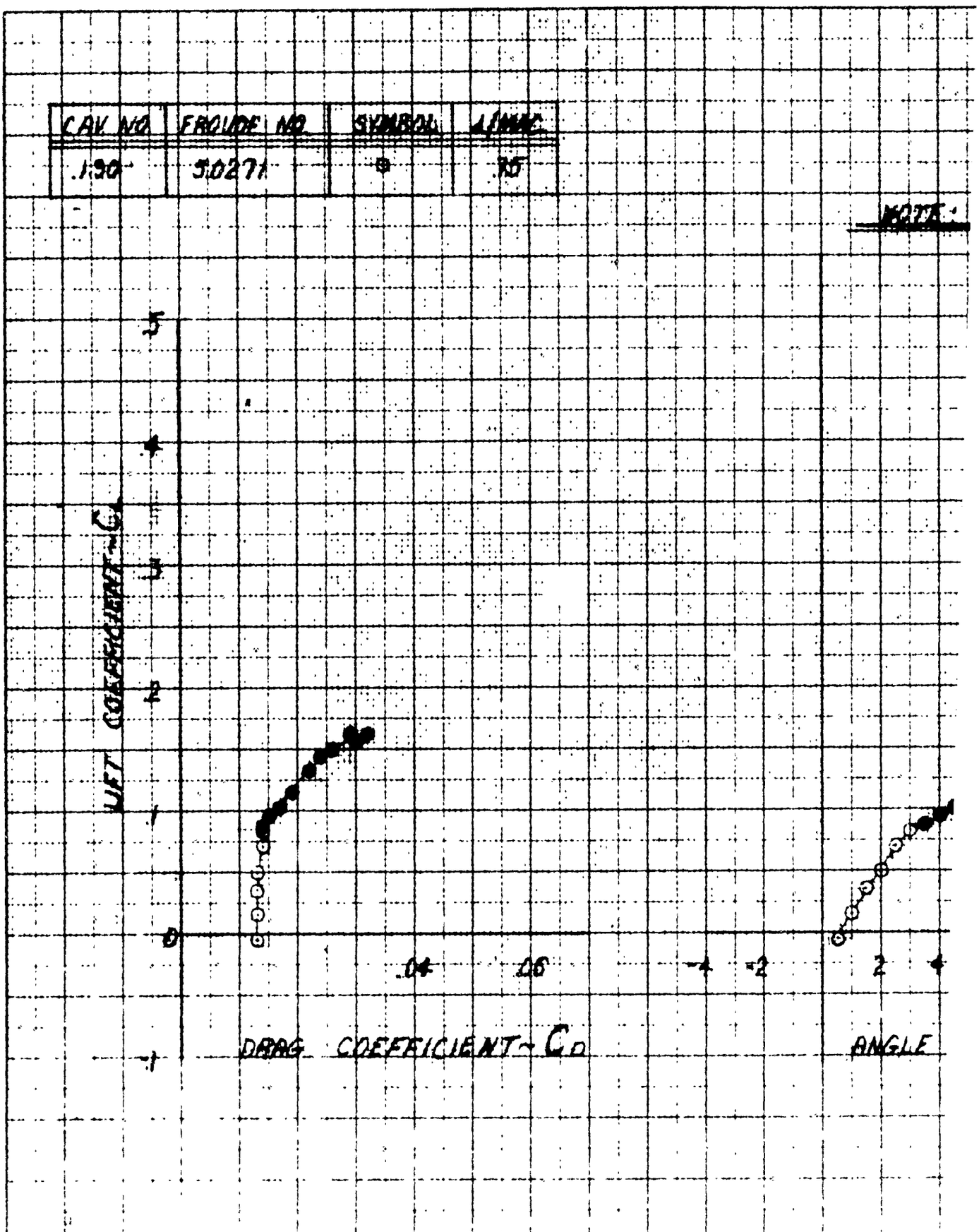
V = 70 KTS.

NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW



GLE OF ATTACK ~ α ~ DEGREES

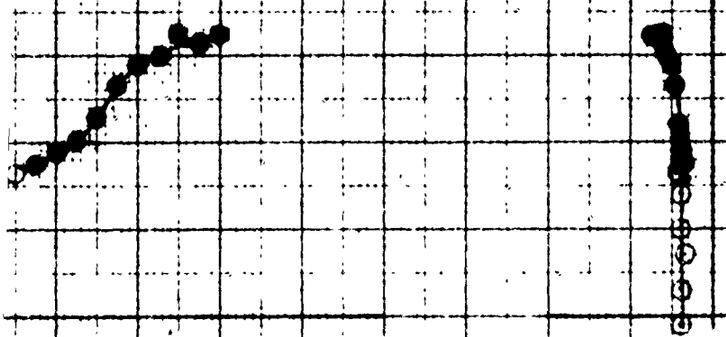
PITCHING MOMENT COEFFICIENT ~ $C_{M_{c/4}}$


CAV NO
FROUDE NO
SYMBOL
.190
5.0271
.75
NOTE:
LIFT COEFFICIENT ~ C_L
.5
.4
.3
.2
.1
0
-.1
.04
.06
-4
-2
2
4
DRAG COEFFICIENT ~ C_D
ANGLE

WHIRLING TANK TEST NO. 40
FOIL NO. II MAC. = 0229 FT.
AREA = 9.60 SQ. IN.

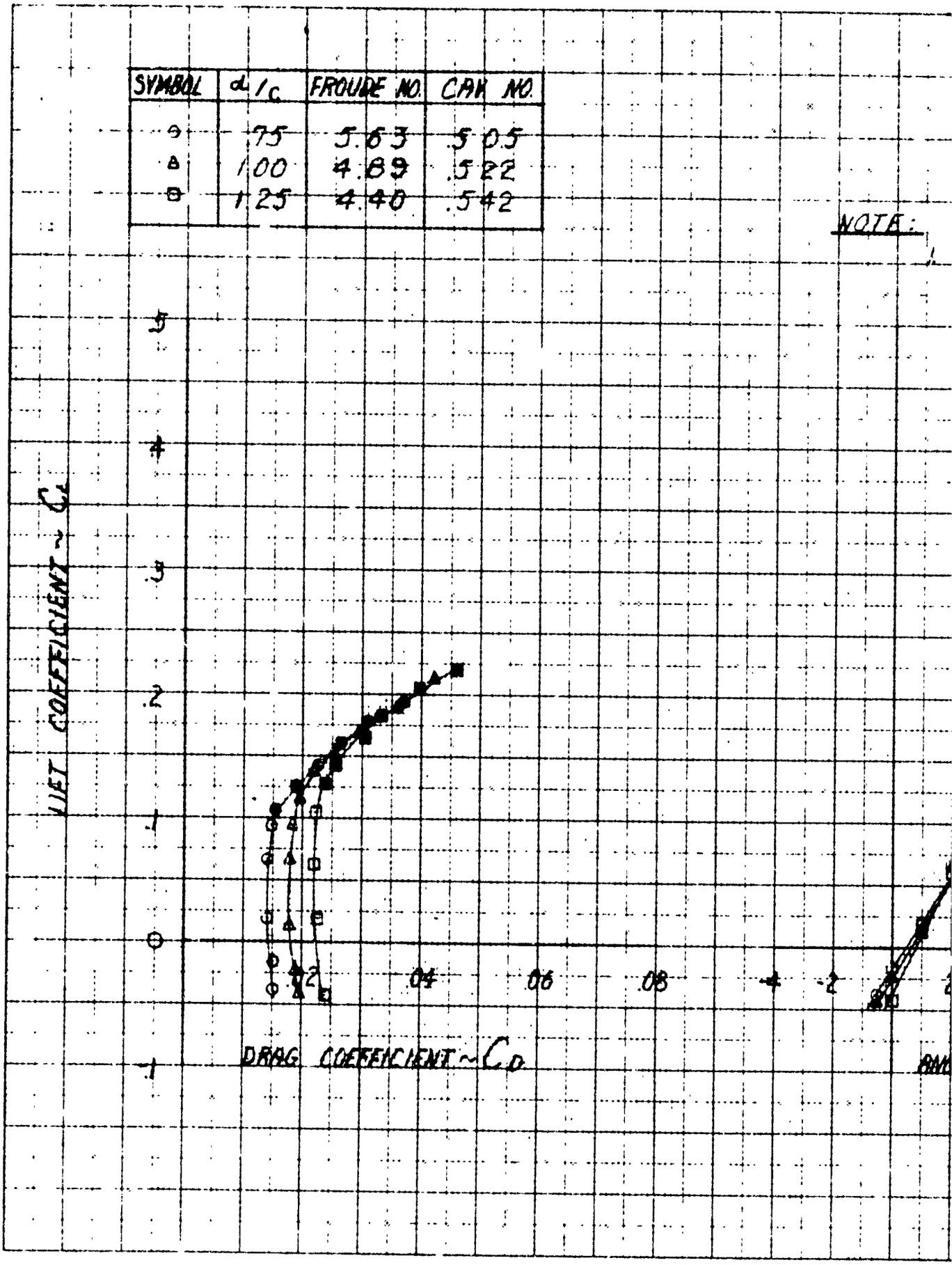
V = 80 MTS.

NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.
2. MODEL FAILED AT α 8°



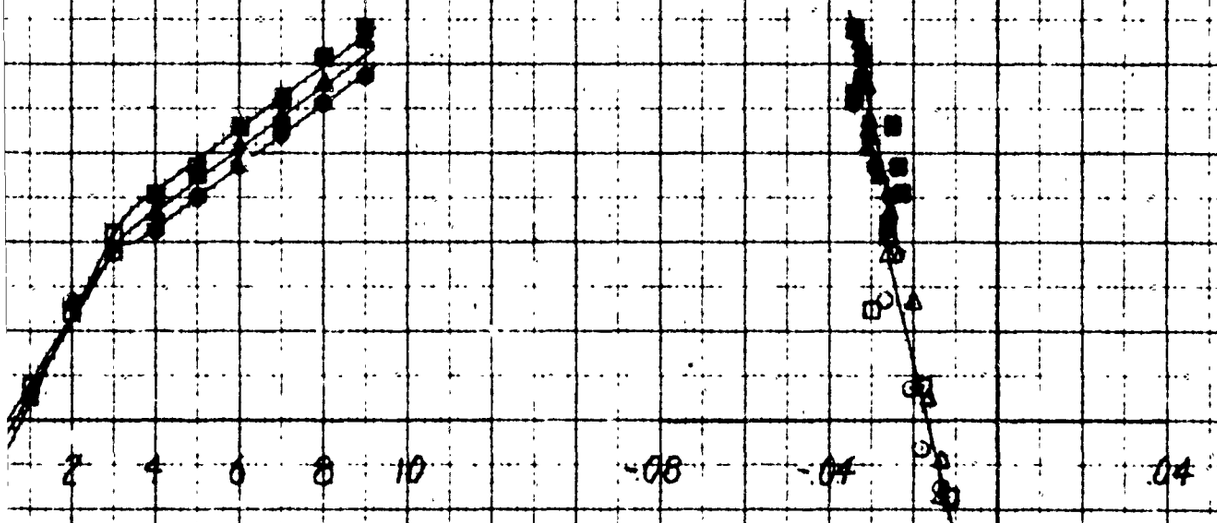
LE OF ATTACK ~ α ~ DEGREES

PITCHING MOMENT COEFFICIENT ~ $C_{M_{C/4}}$


SYMBOL
d/c
FROUDE NO.
CAV NO.
75
5.63
.505
100
4.89
.522
125
4.40
.542
NOTE:
LIFT COEFFICIENT ~ C_L
DRAG COEFFICIENT ~ C_D
5
4
3
2
1
0
-1
.2
.4
.6
.8
-4
-2

WHIRLING TANK TEST NO. 51
BU SHIPS FOIL NO. 12
MAC. = 1.82 FT ; S = 8.00 FT²
V = 40 KTS.

1. DARKENED POINTS INDICATE VENTED FLOW

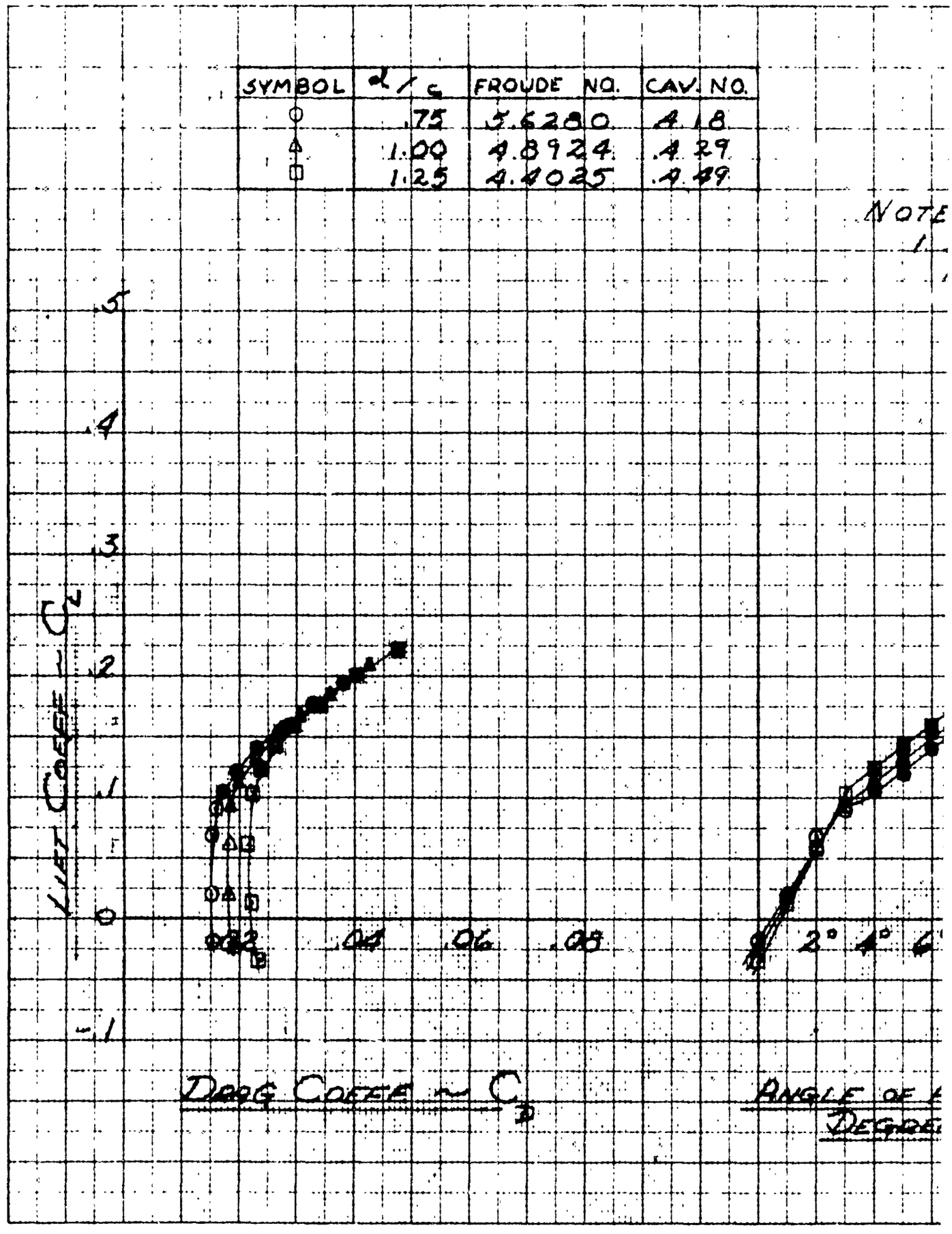


ANGLE OF ATTACK ~ α ~ DEG.

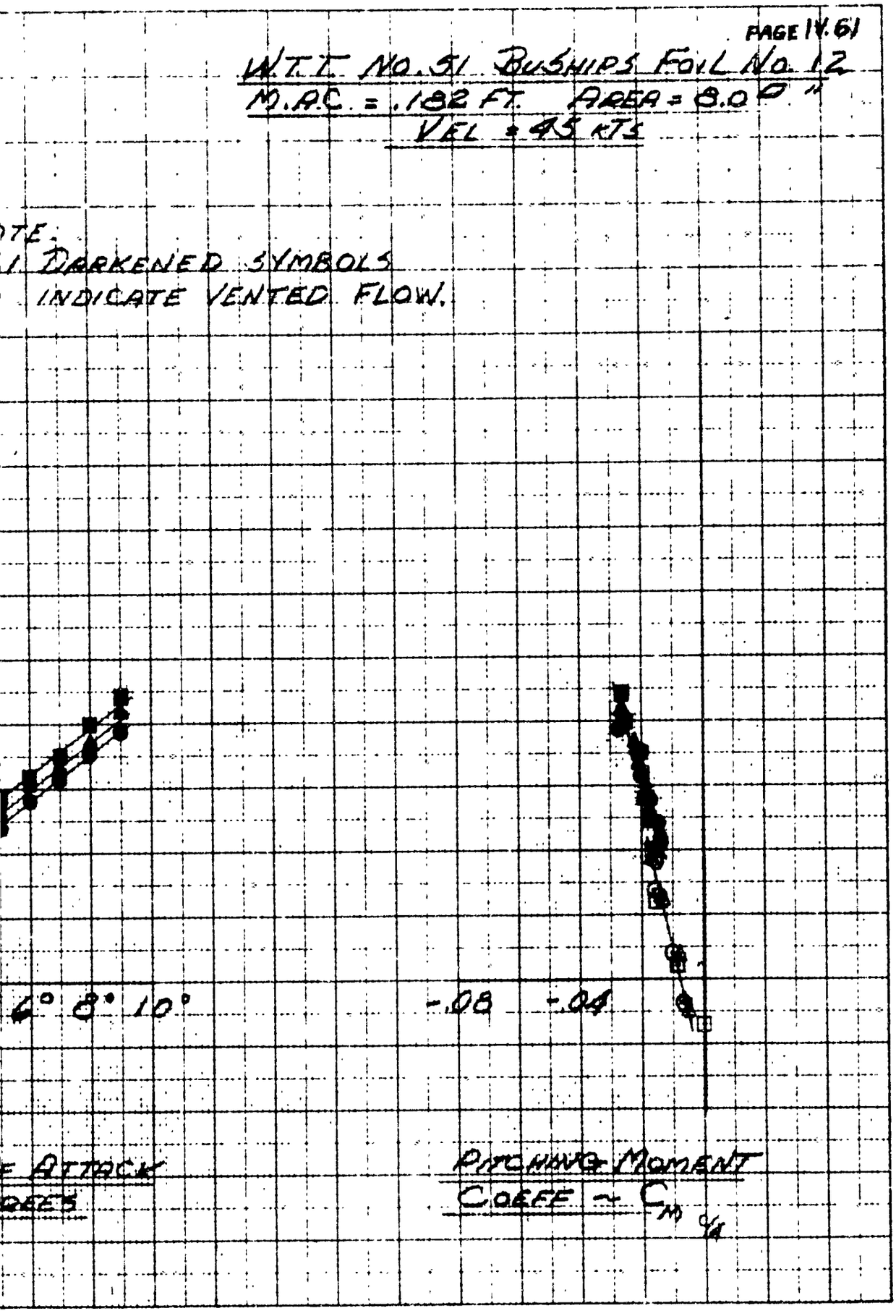
PITCHING MOMENT COEFFICIENT ~ $C_{M_{c/4}}$

SYMBOL	ℓ / c	FROUDE NO.	CAV. NO.
○	.75	5.6200	.418
△	1.00	4.8924	.429
□	1.25	4.4025	.449

NOTE

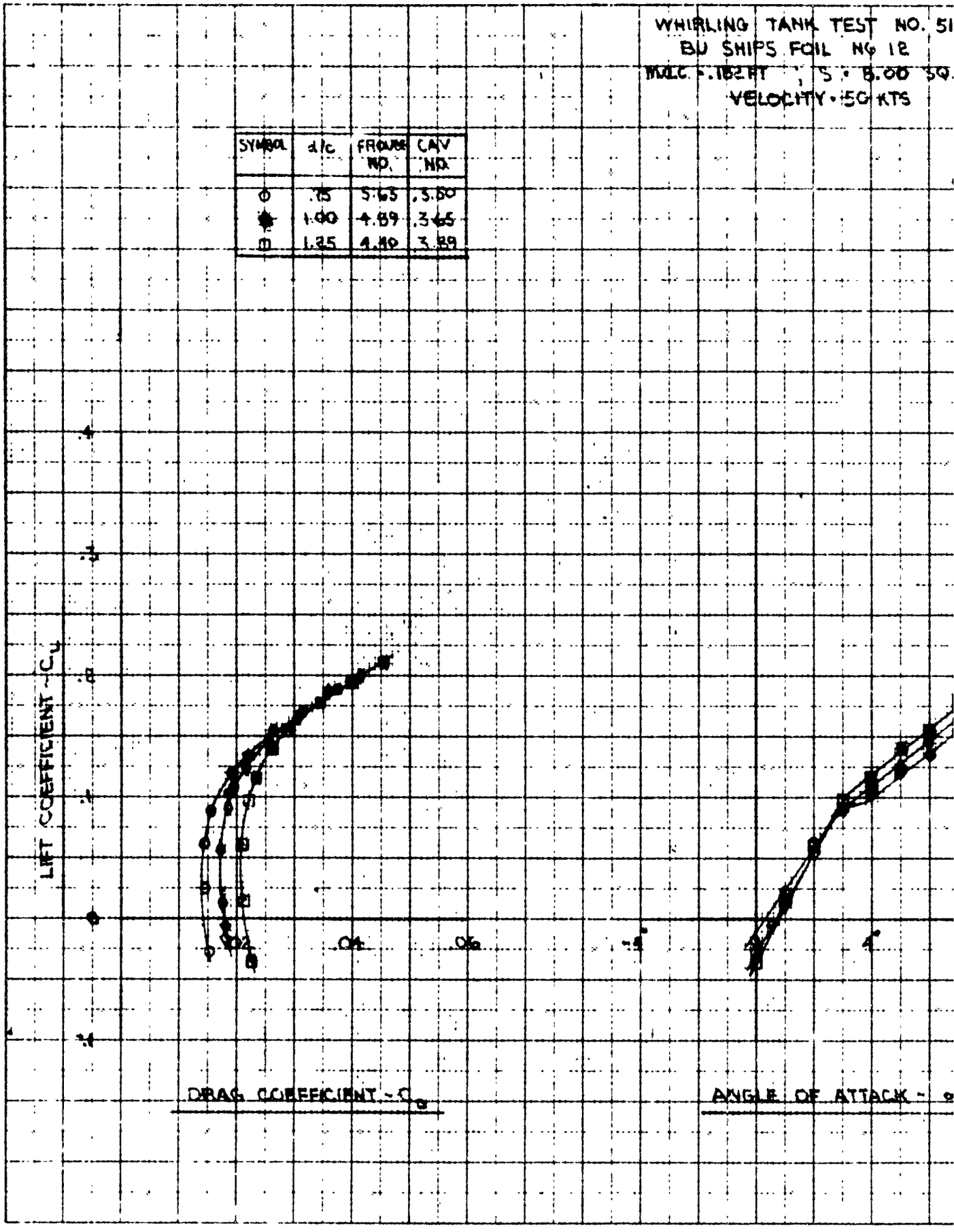


W.T.T. NO. 51 BUSHIPS FOIL NO. 12
M.A.C. = .182 FT. AREA = 8.0 □"
VEL = 45 KTS



WHIRLING TANK TEST NO. 51
BU SHIPS FOIL NO 12
MULC .182 FT , S = 8.00 SQ.
VELOCITY = 50 KTS

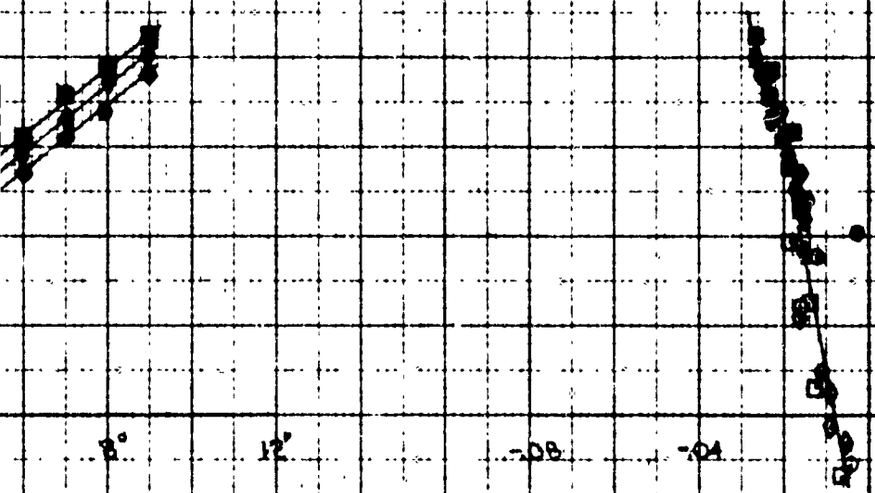
SYMBOL	d/c	FROUDE NO.	CAV NO.
○	.15	5.65	3.80
✱	1.00	4.89	3.65
□	1.25	4.80	3.89



D. 51

SQ. IN.

NOTE: DARKENED POINTS INDICATE VENTED FLOW



8°

12°

-.08

-.04

+.04

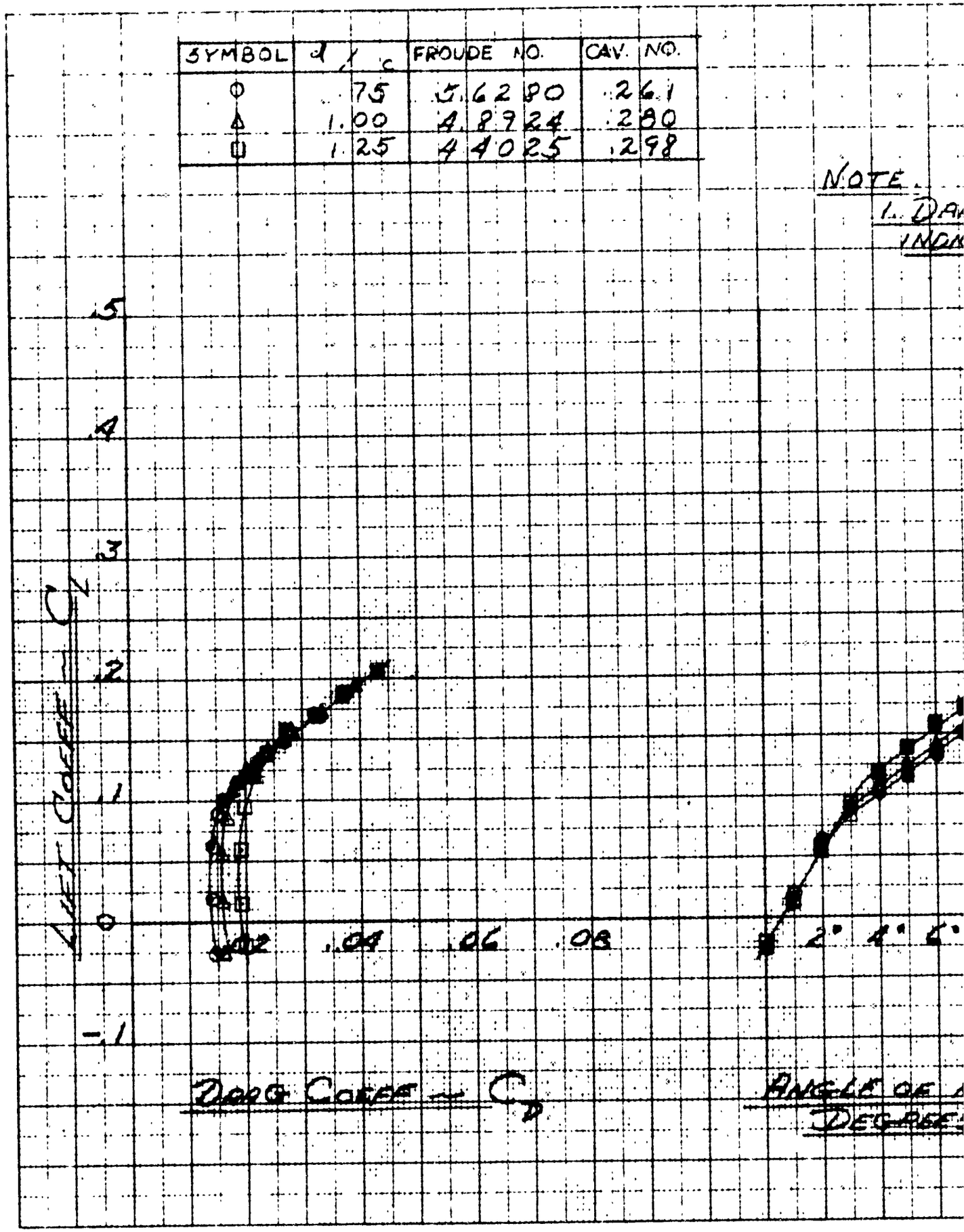
α - DEGREES

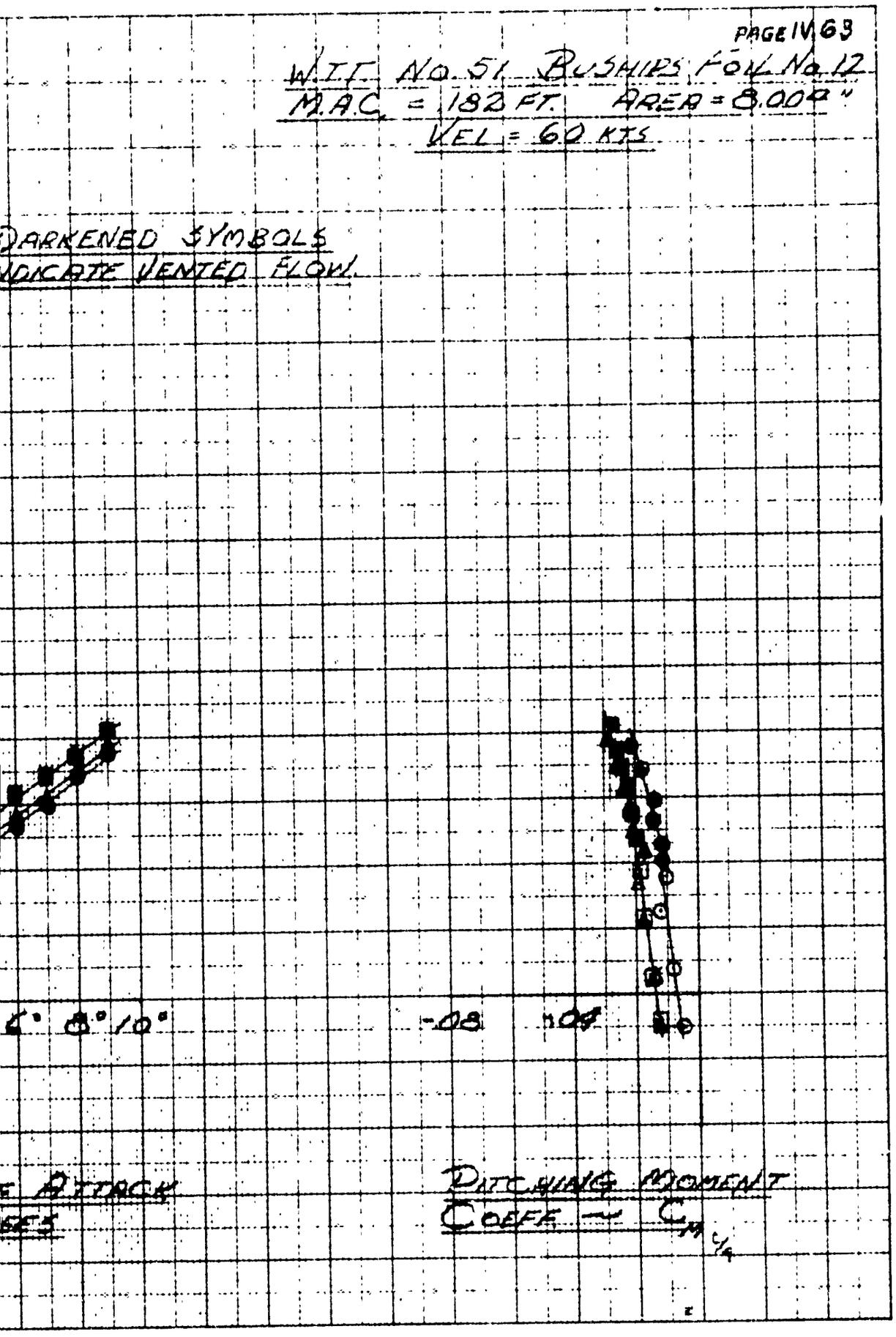
PITCHING MOMENT COEFFICIENT - $C_{m_{c/4}}$

SYMBOL	$\frac{d}{c}$	FROUDE NO.	CAV. NO.
○	.75	5.6280	.261
△	1.00	4.8724	.280
□	1.25	4.4025	.298

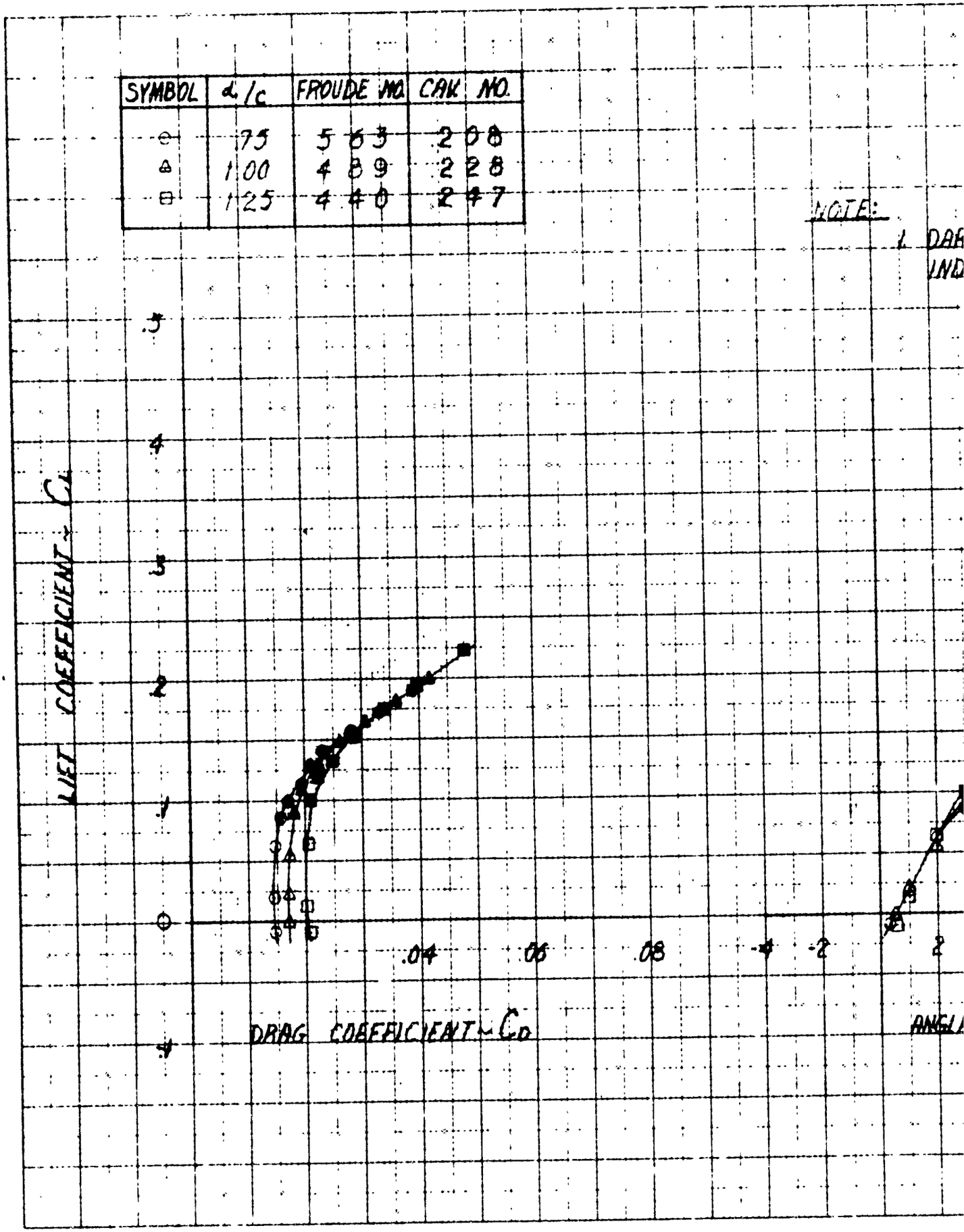
NOTE.

1. DA
INDU



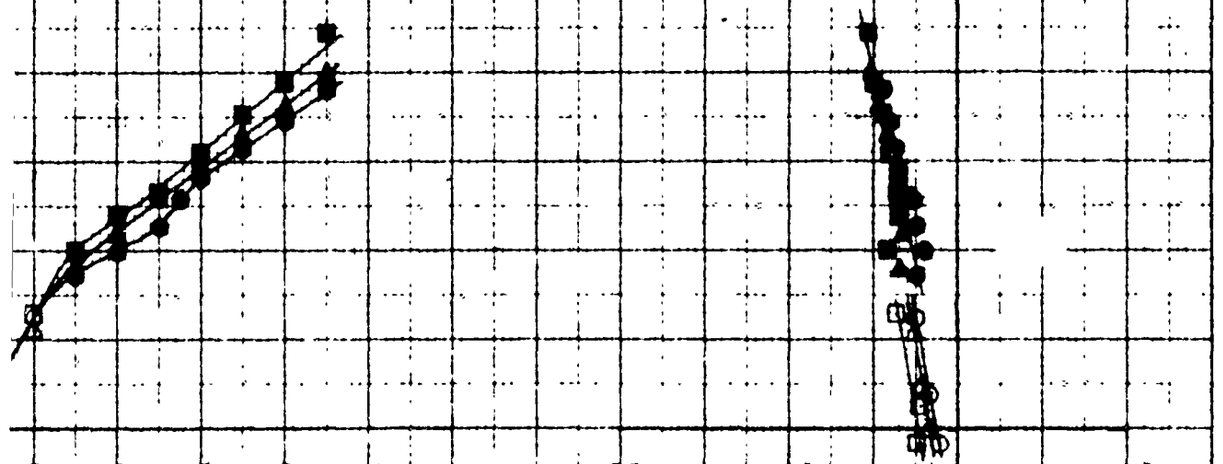

PAGE IV 63
W.T.T. No. 51 BUSHIPS FOIL No. 12
M.A.C. = .182 FT. AREA = 8.00 □"
VEL = 60 KTS
DARKENED SYMBOLS
INDICATE VENTED FLOW.
6° 8° 10°
-.08
+.04
E ATTACK
EES
PITCHING MOMENT
COEFF ~ $C_{M_{c/4}}$

SYMBOL	ℓ/c	FROUDE NO.	CAV NO.
○	.75	5.63	.208
△	1.00	4.89	.228
□	1.25	4.40	.247



WHIRLING TANK TEST NO. 51
BU SHIPS FOIL NO. 12
MAC = 1.82 FT.; S = 8.06 IN²
V = 70 KTS.

DARKENED POINTS
INDICATE VENTED FLOW.

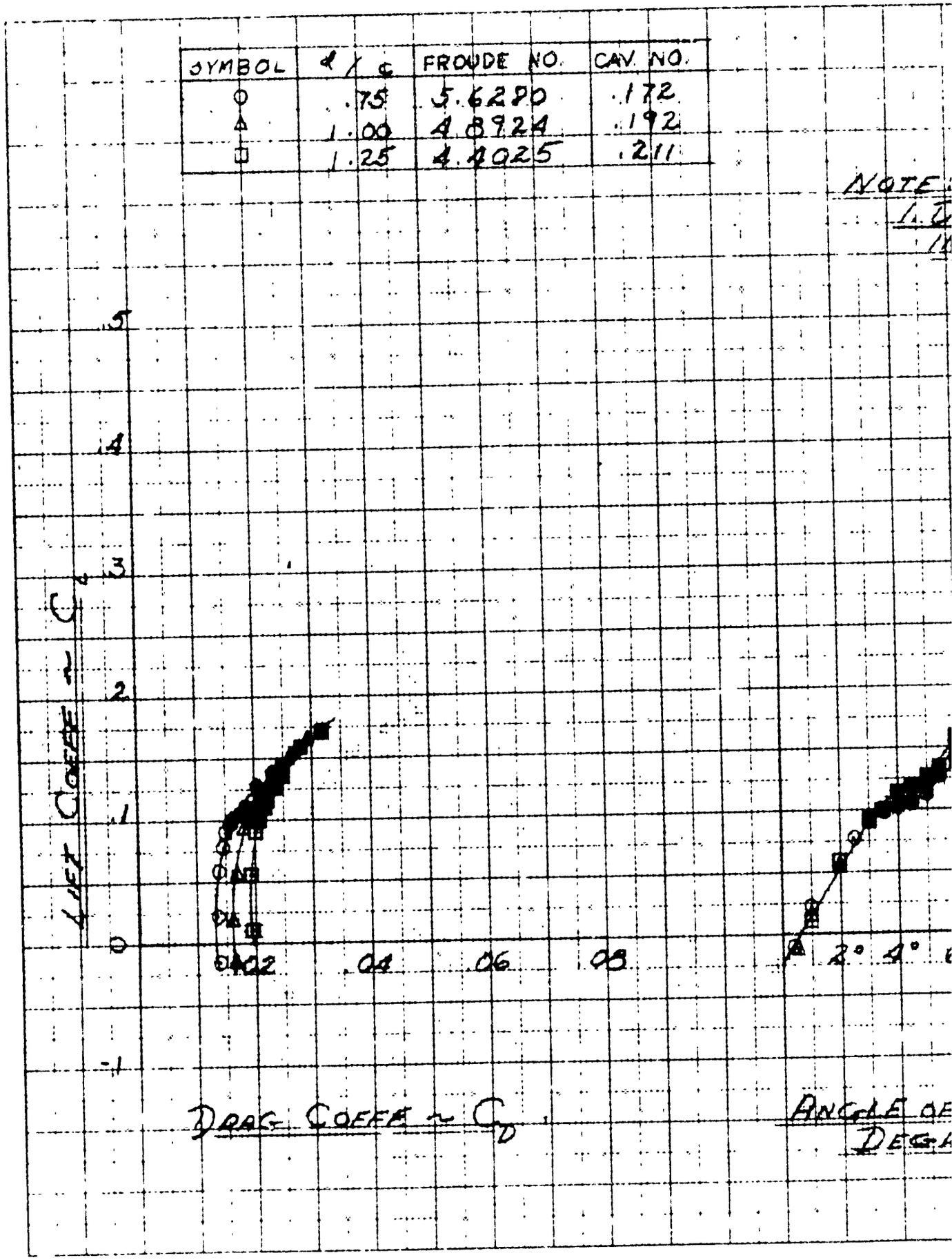


ANGLE OF ATTACK ~ α - DEG

PITCHING MOMENT COEFFICIENT ~ $C_{m_{1/4}}$

SYMBOL	ℓ / c	FROUDE NO.	CAV. NO.
○	.75	5.6280	.172
△	1.00	4.8924	.192
□	1.25	4.4025	.211

NOTE
1.0
1



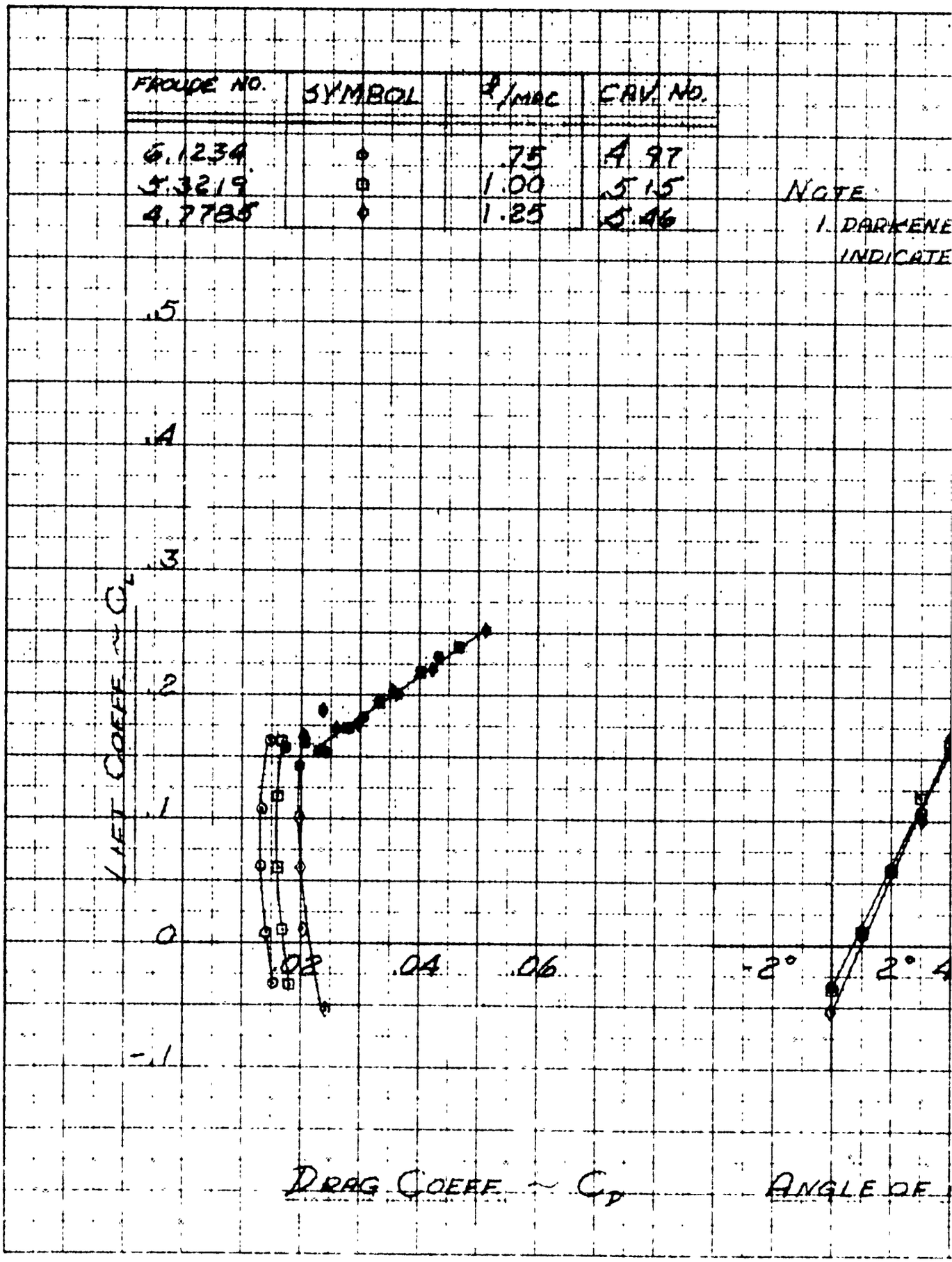
W.T.T. No. 51 Buships Foil No. 12.
M.A.C. = .182 FT. AREA = 0.004 "
VEL = 80 KTS

E.
. DARKENED SYMBOLS
INDICATE VENTED FLOW.

° 6° 8° 10° -.08 -.04

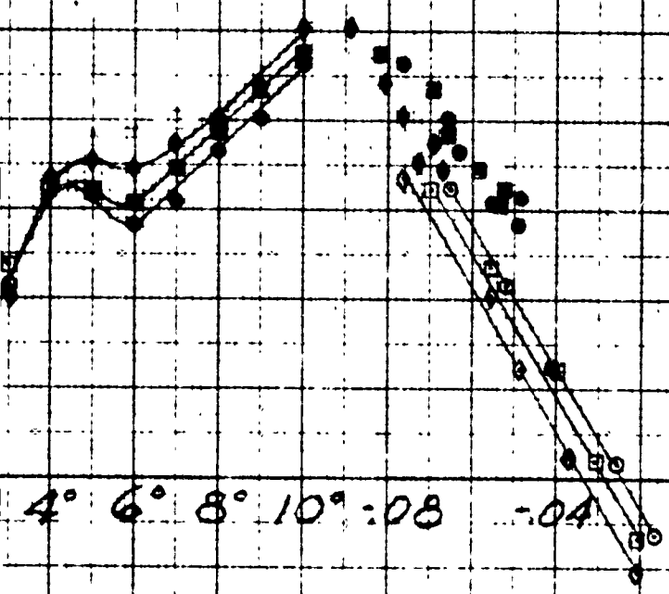
OF ATTACK
GREES

PITCHING MOMENT
COEFF - $C_{M_{c/4}}$


FROUDE NO.
SYMBOL
R/MAC
CAV. NO.
6.1234
.75
A 97
5.3219
1.00
5.15
4.7785
1.25
5.96
NOTE
1. DARKENE
INDICATE
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF ~ C_L
.02
.04
.06
-2°
2°
DRAG COEFF ~ C_D
ANGLE OF

WHIRLING TANK TEST NO 41
BUSHIPS FOIL NO. 13
M.A.C. = .152 FT. AREA = 8.5 SQ IN
V = 40 KTS

ENED SYMBOLS
TE VENTED FLOW

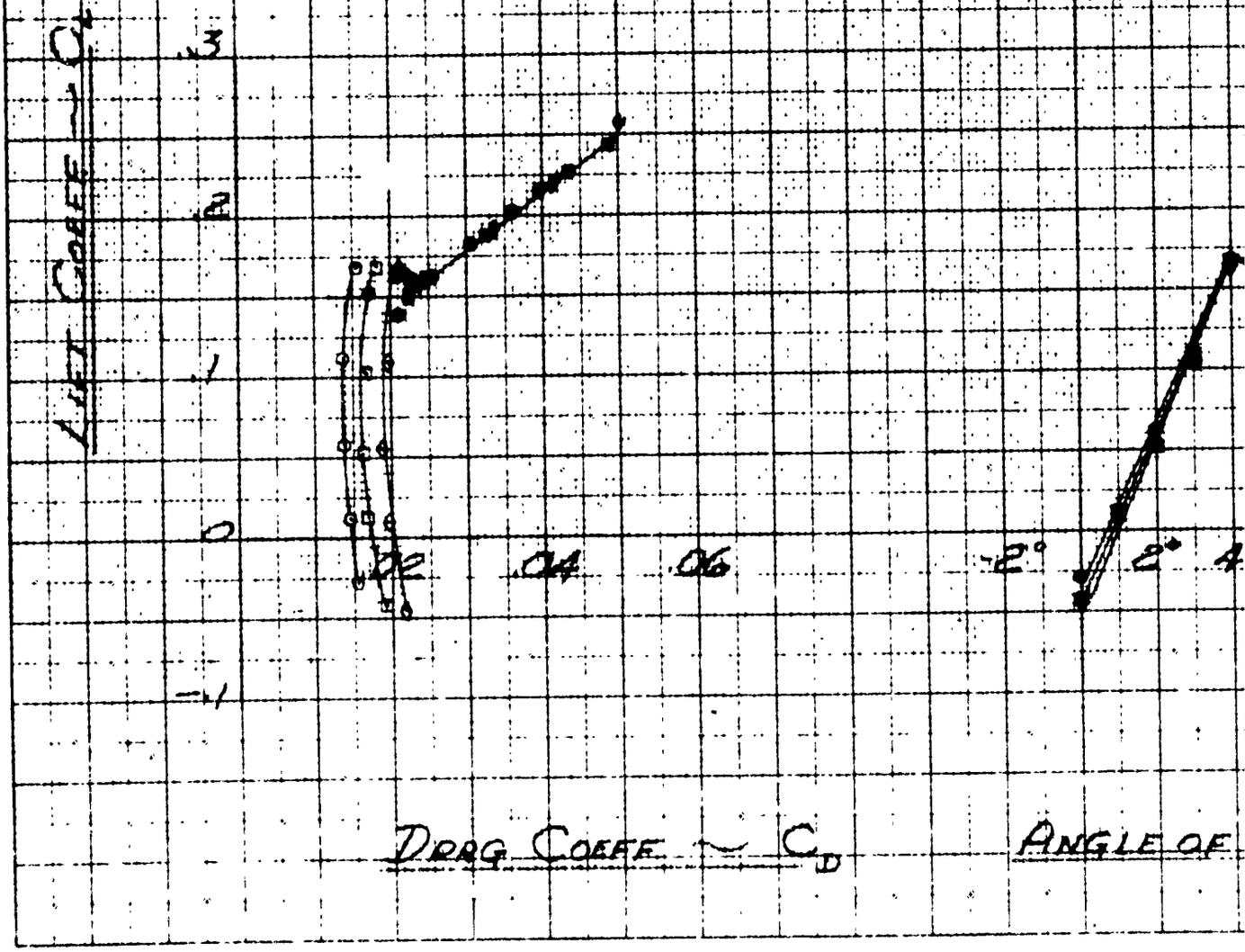


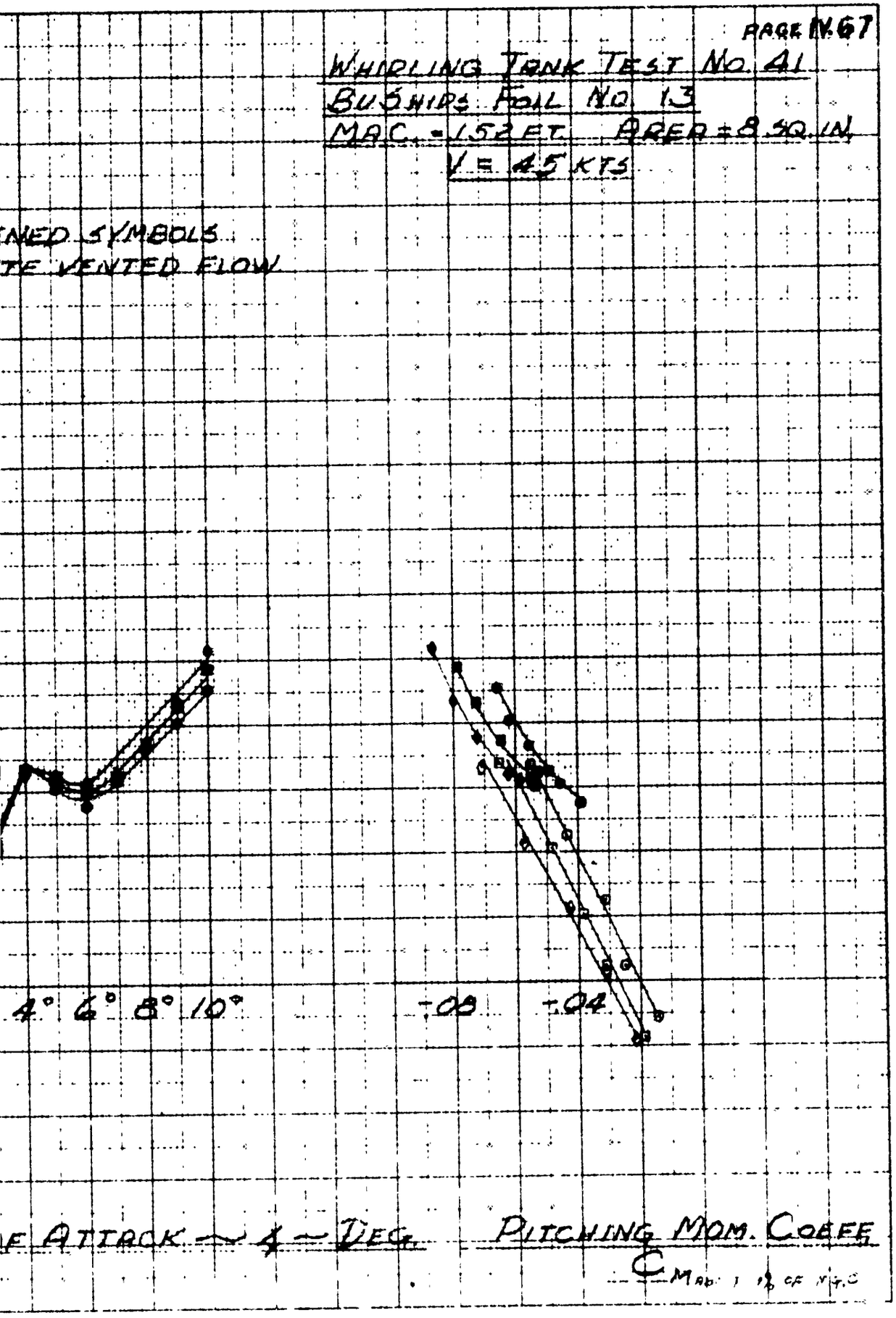
4° 6° 8° 10° :08 -.04 .04

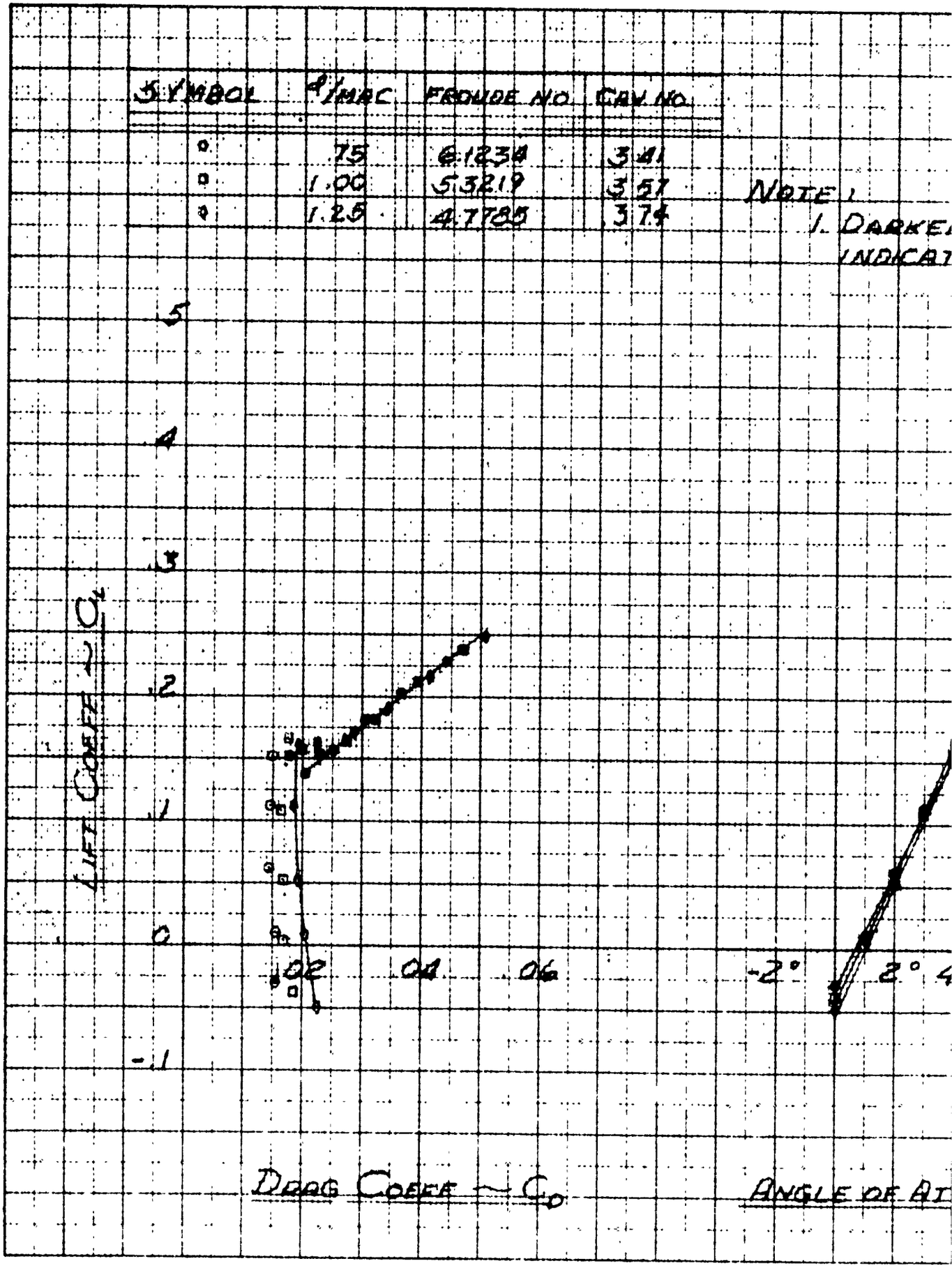
E ATTACK ~ α ~ DEG. PITCHING MOMENT COEFF C_M ABOUT ¼% OF MAC

FIGURE NO.	SYMBOL	q/q_{max}	CAK NO.
6.1234	○	.75	.406
5.3219	□	1.00	.425
4.7705	◇	1.25	.431

NOTE
1. DARKEN
INDICATE

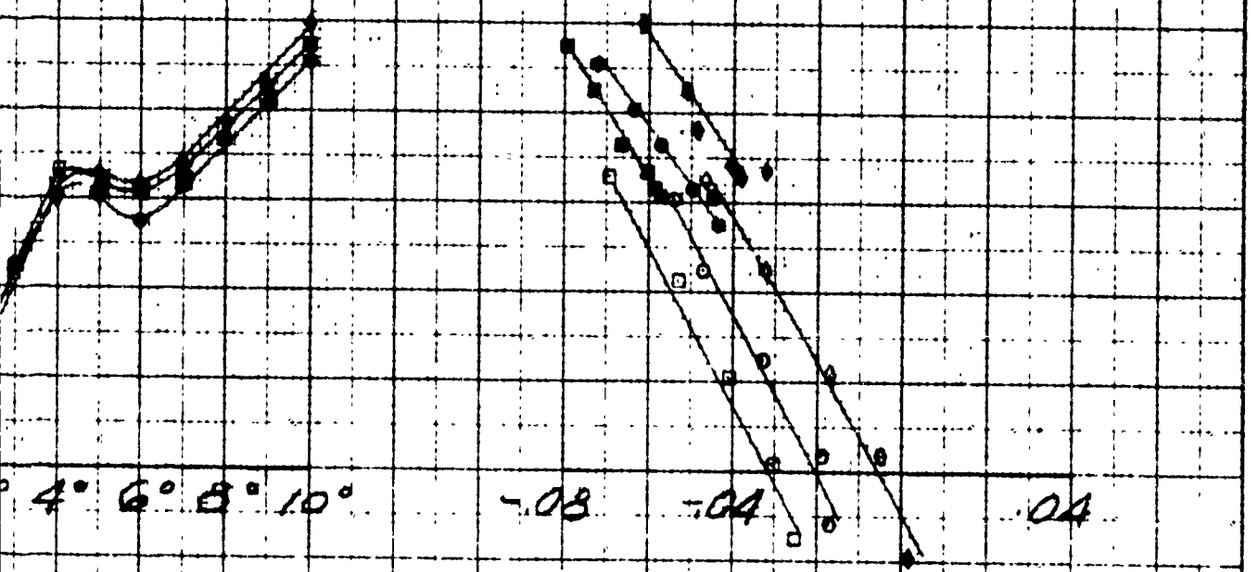



PAGE IV.67
WHIRLING TANK TEST NO. 41
BUSHIPS FOIL NO. 13
MAC. = 1.52 FT. AREA = 8 SQ. IN.
V = 45 KTS
NED SYMBOLS
TE VENTED FLOW
4° 6° 8° 10°
-.08 -.04
F ATTACK ~ 4 ~ DEG.
PITCHING MOM. COEFF
$C_{M_{AB}}$ 1 % OF N.G.C


SYMBOL
ϕ_{MAC}
FROUDE NO.
CAV. NO.
○ .75 6.1234 .341
□ 1.00 5.3219 .357
◇ 1.25 4.7785 .374
NOTE:
1. DARKE
INDICAT
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF — C_L
.02
.04
.06
-2°
2°
DRAG COEFF — C_D
ANGLE OF AT

WHIRLING TANK TEST NO. 41
BUSHIPS FOIL NO 13
M.A.C. = .152 FT AREA = .8 FT²
V = 50 KTS

KENED. SYMBOLS
CATE VENTED FLOW.



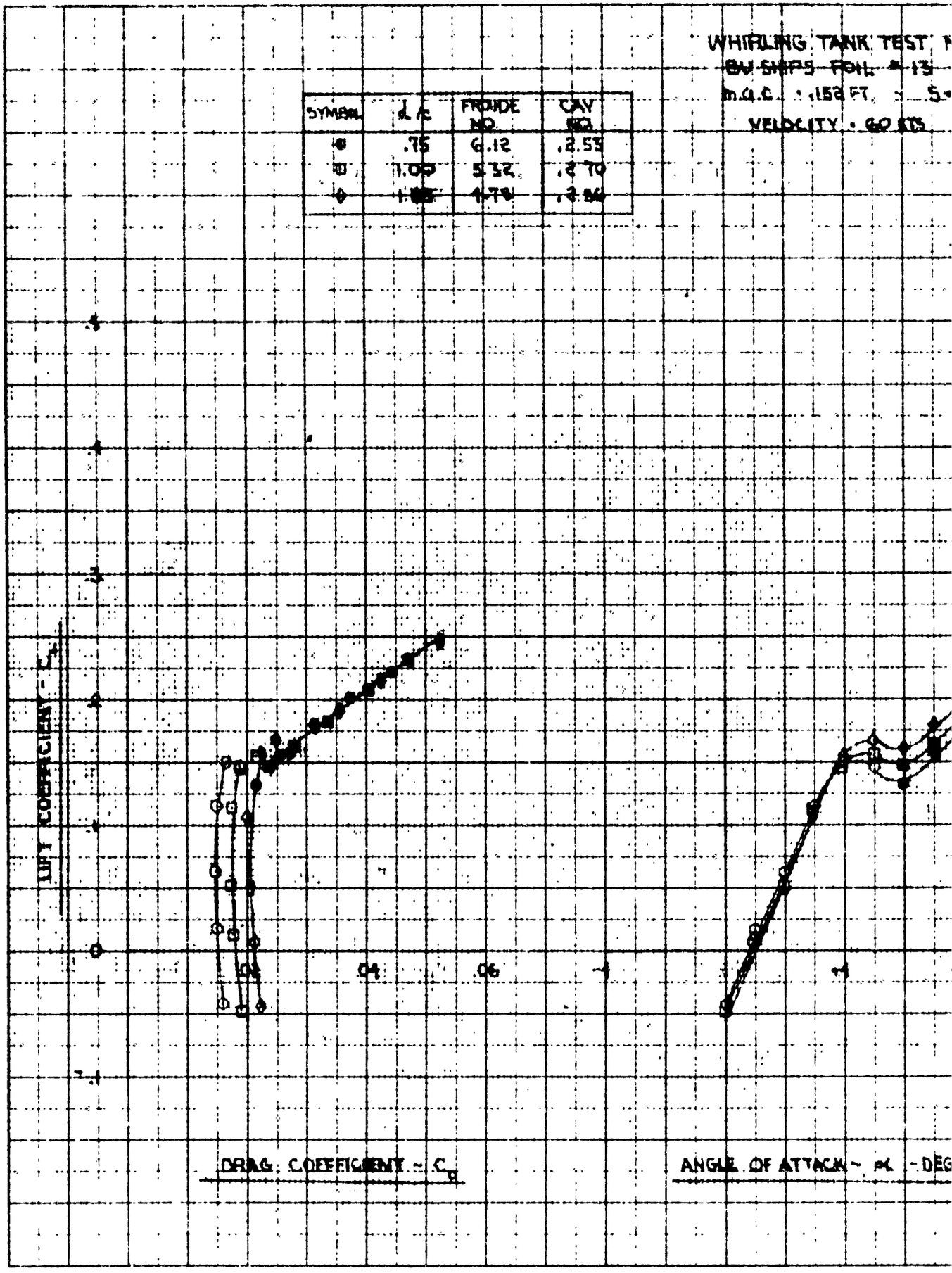
° 4° 6° 8° 10°

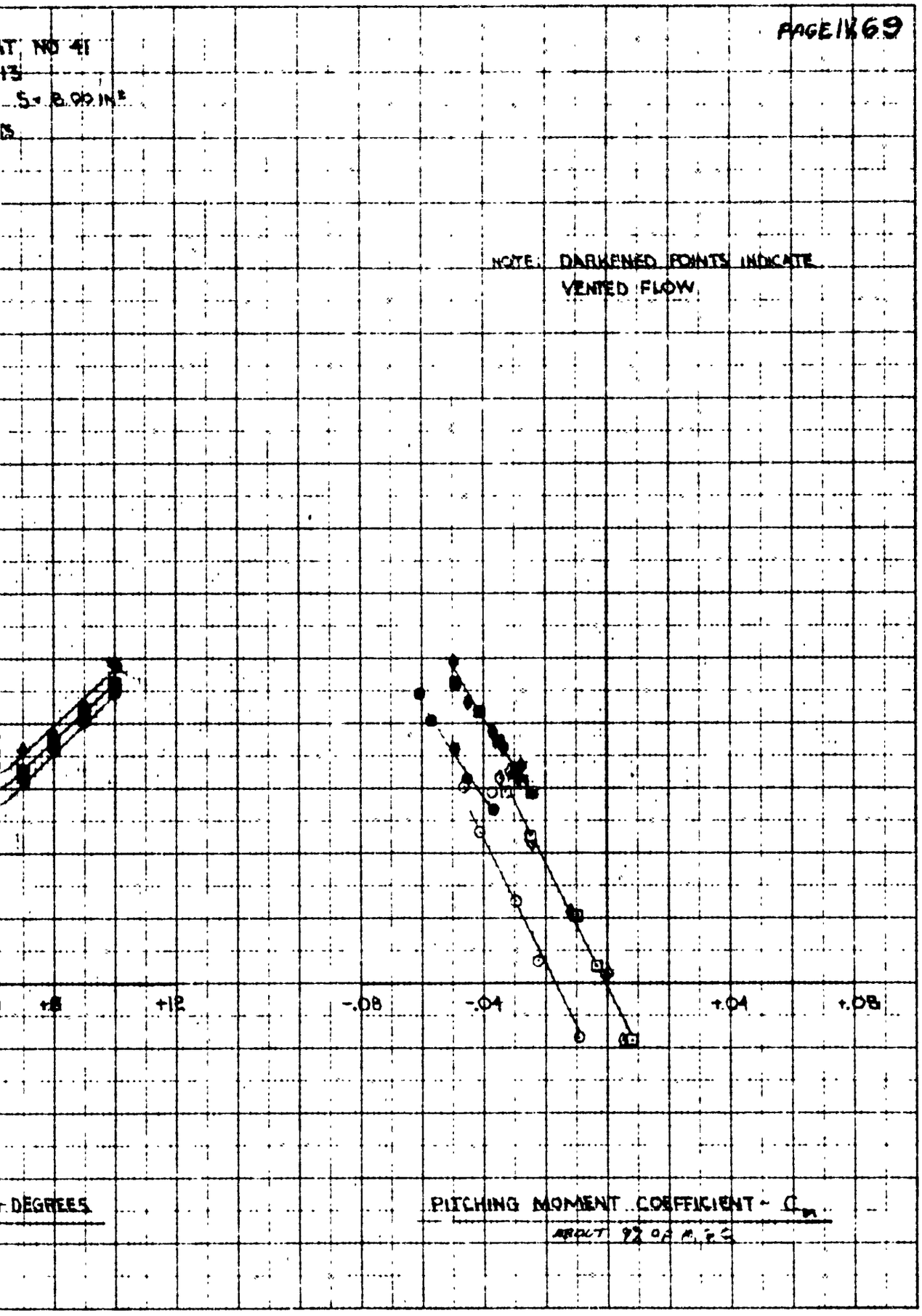
-.08 -.04 .04

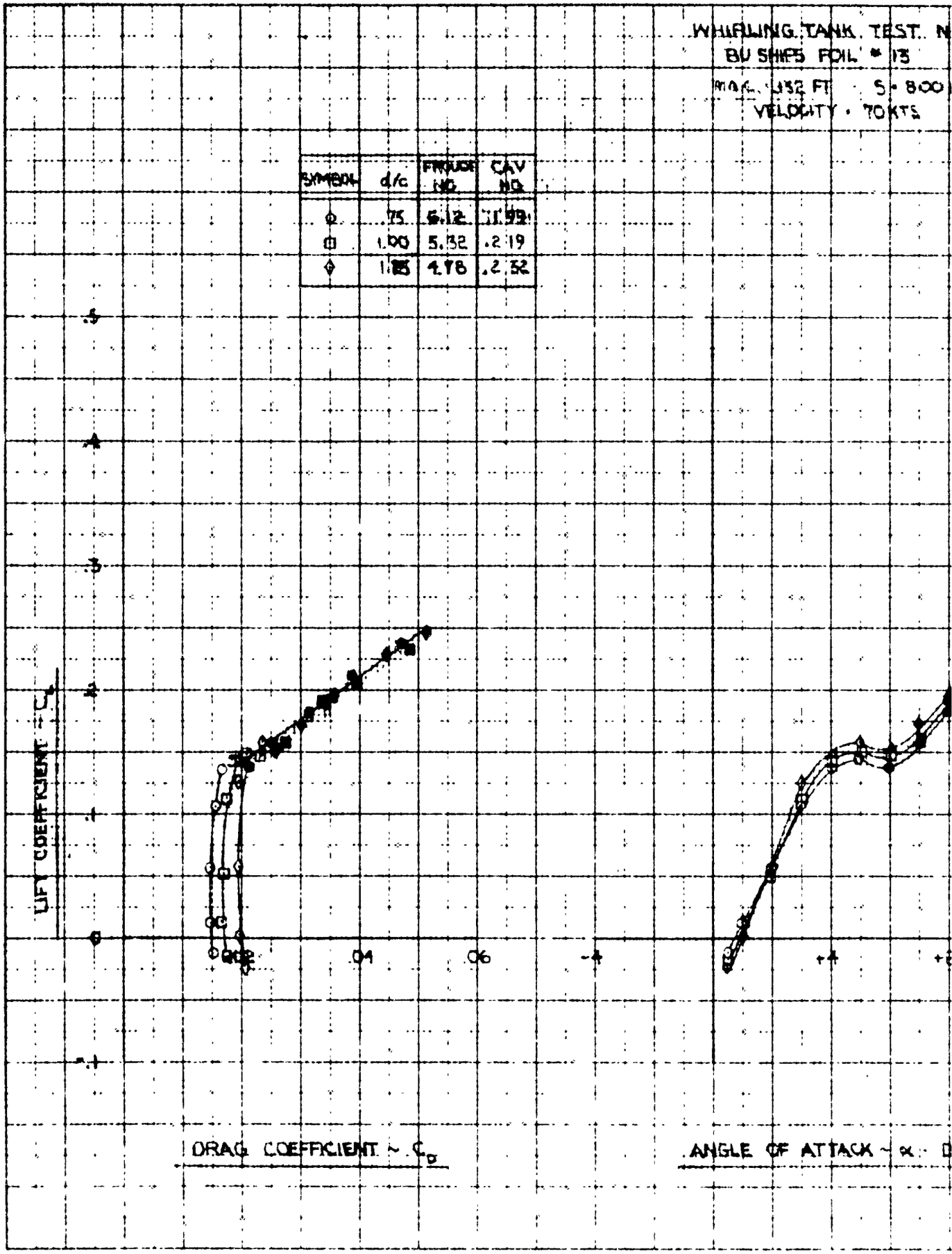
ATTACK — α — DEG

PITCHING MOMENT COEFF — C_M

ABOUT 1/2 OF MGC


WHIRLING TANK TEST
BU SHIPS FOIL
m.a.c. = .152 FT.
VELOCITY = 60 KTS
SYMBOL
FROUDE NO
CAV NO
.75
6.12
.2.55
1.00
5.32
.2.70
LIFT COEFFICIENT - C_L
.04
.06
DRAG COEFFICIENT - C_d
ANGLE OF ATTACK - α_L - DEG


PAGE IV 69
T NO 41
13
S = 8.00 IN²
NOTE: DARKENED POINTS INDICATE VENTED FLOW
+8
+12
-.08
-.04
+.04
+.08
DEGREES
PITCHING MOMENT COEFFICIENT ~ C_m
ABOUT 9% OF M.G.C.


WHIRLING TANK TEST N
BU SHIPS FOIL # 13
MAX. 1.32 FT S = 8.00
VELOCITY = 70 KTS
SYMBOL
d/c
FROUDE NO.
CAV NO.
.75
6.12
1.00
5.32
.2 19
1.25
4.78
.2 32
LIFT COEFFICIENT ~ C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-4
+4
DRAG COEFFICIENT ~ C_D
ANGLE OF ATTACK ~ α

T. NO. 41

300 IN²
S

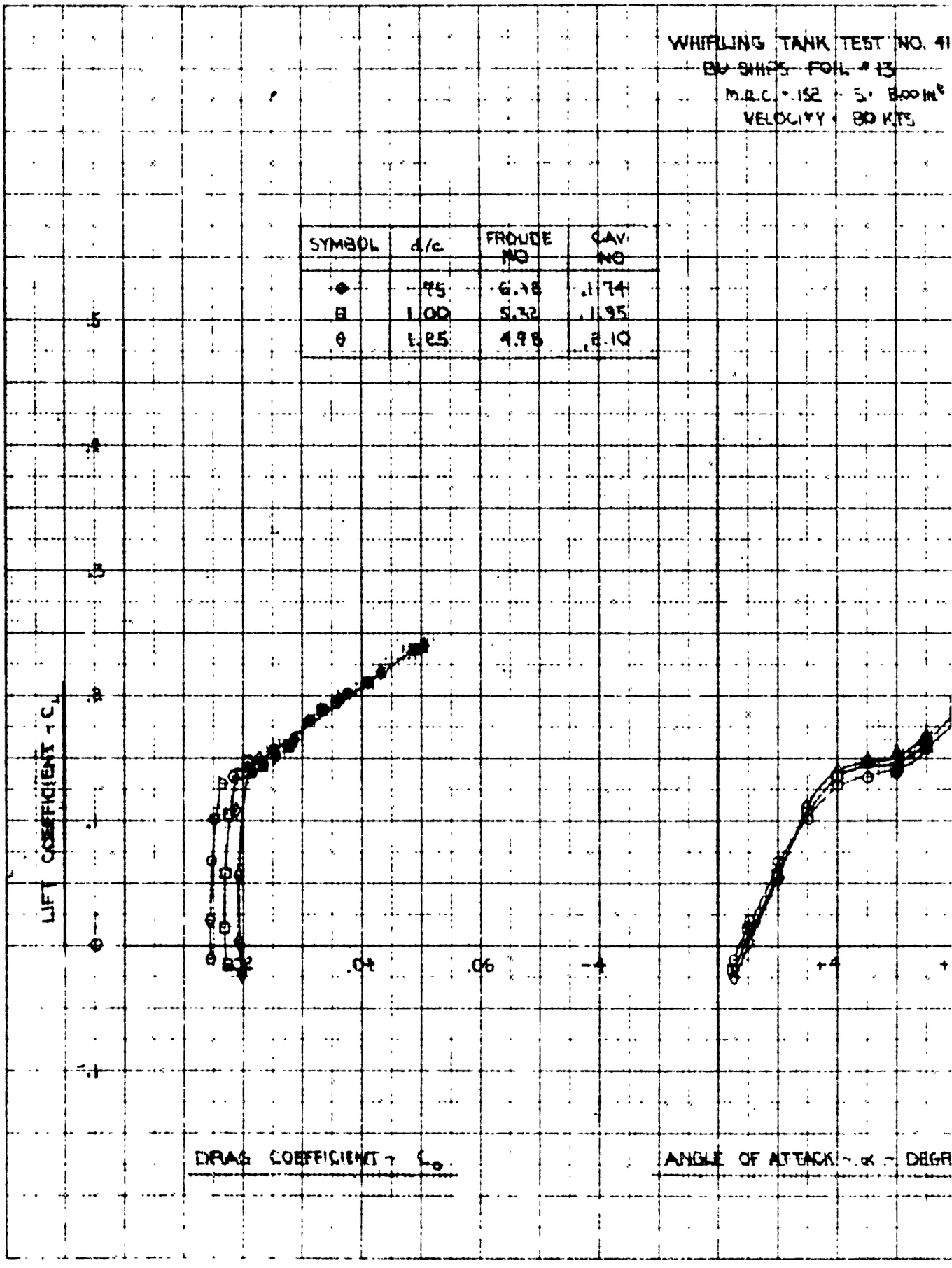
NOTE : DARKENED POINTS INDICATE VENTED FLOW.

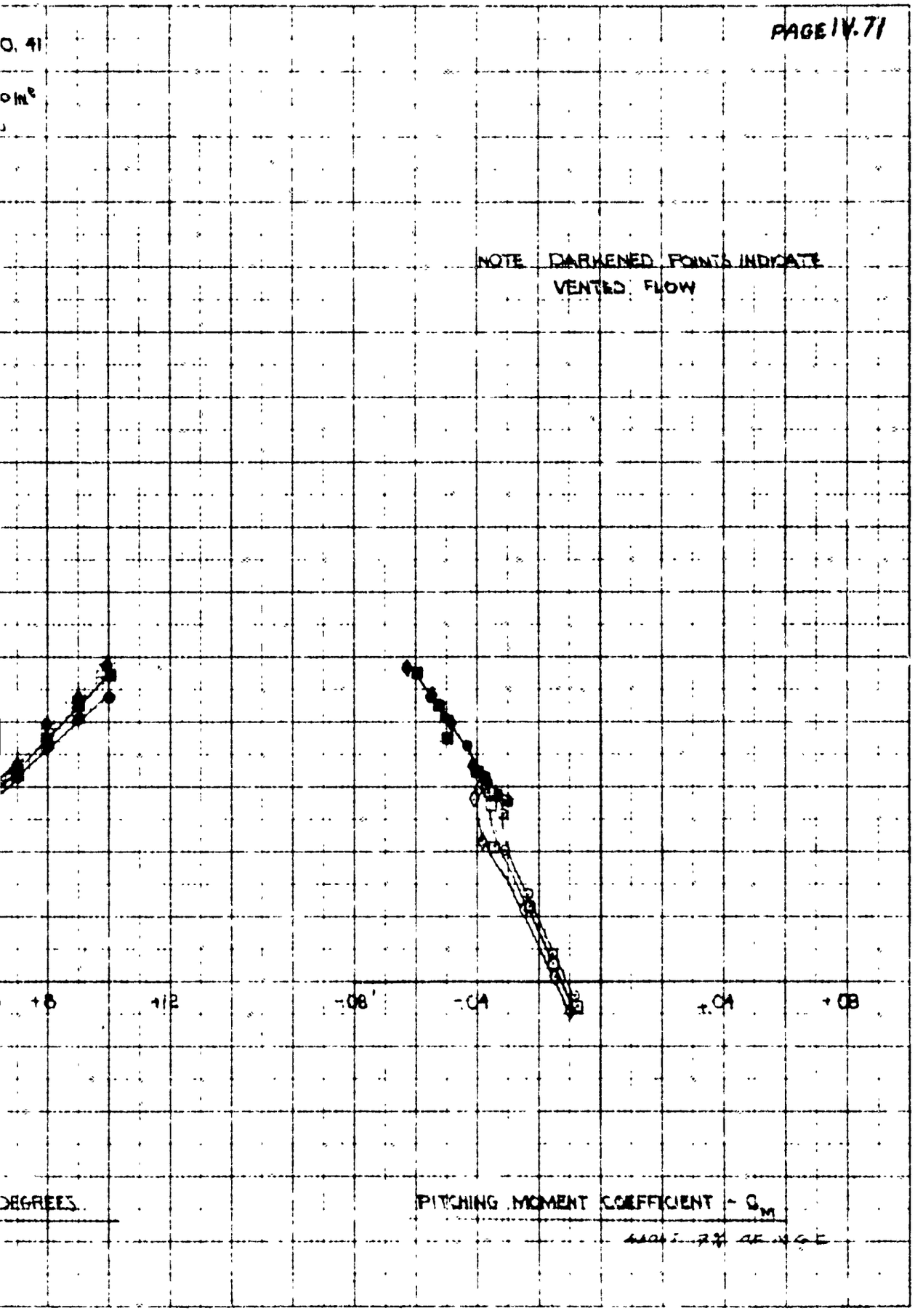
+.8 +.12 -.08 -.04 +.04 +.08

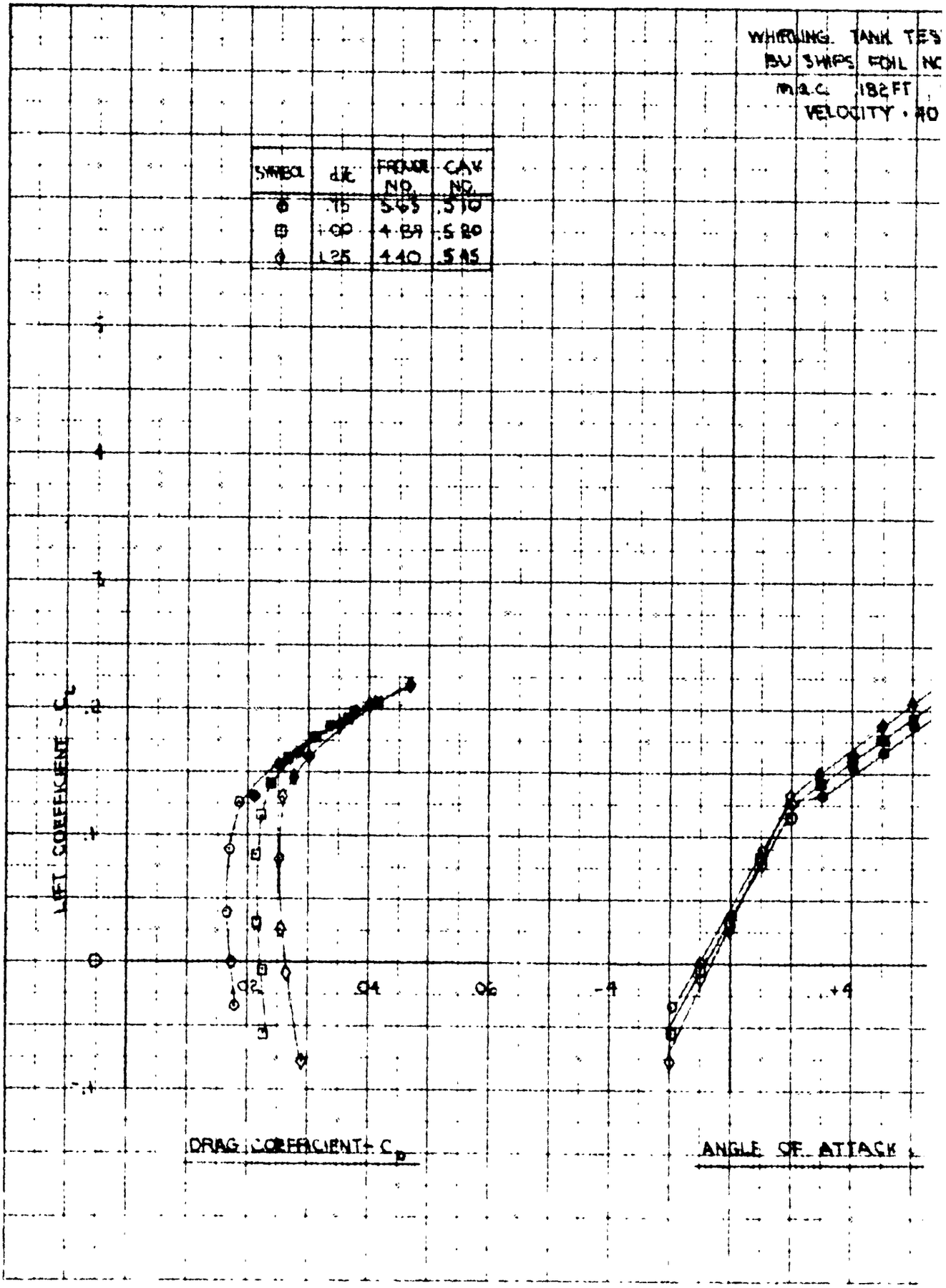
DEGREES

PITCHING MOMENT COEFFICIENT ~ C_M

ABOUT 25% OF MAC

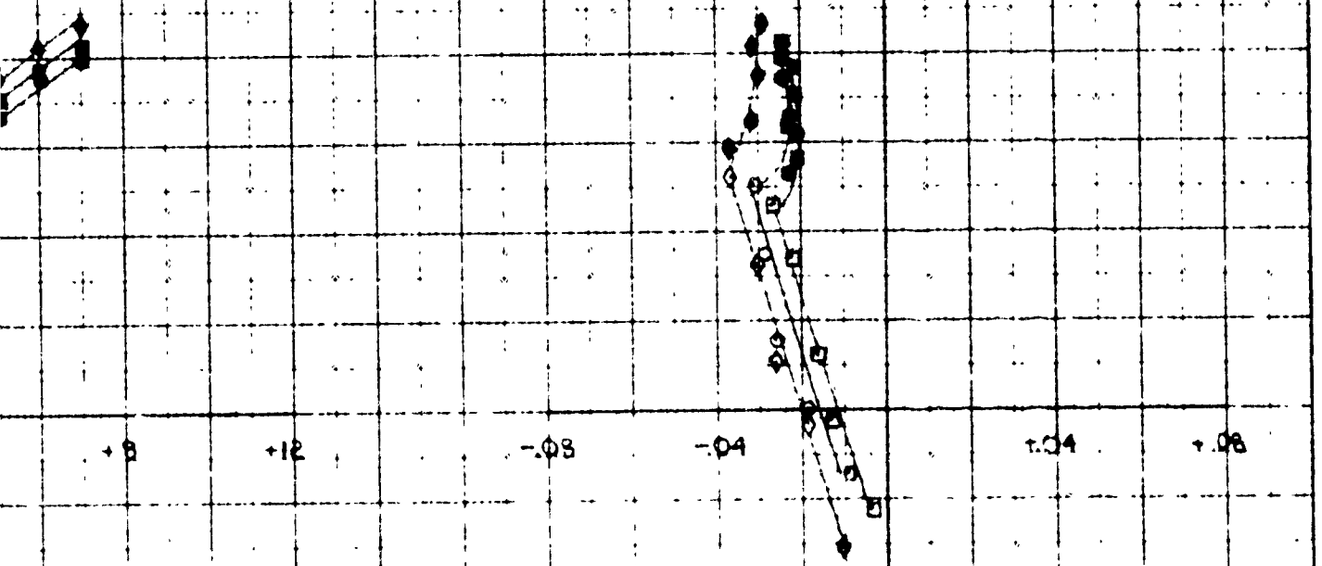

WHIRLING TANK TEST NO. 41
BU SHIPS FOIL # 13
M.A.C. = .152 S. 800 IN²
VELOCITY = 30 KTS
SYMBOL
d/c
FROUDE NO
CAV NO
.75
6.18
.174
1.00
5.32
.195
1.25
4.98
.210
LIFT COEFFICIENT - C_L
.04
.06
-4
+4
DRAG COEFFICIENT - C_D
ANGLE OF ATTACK - α - DEGR


O. 41
NOTE DARKENED POINTS INDICATE VENTED FLOW
+8
+12
-.08
-.04
+.04
+.08
DEGREES
PITCHING MOMENT COEFFICIENT - C_M


WHIRLING TANK TES
BU SHIPS FOIL NO
M.S.C. 182 FT
VELOCITY · 40
SYMBOL
d/c
FROUDE NO.
CAV NO.
.15
5.65
.510
+.00
4.89
.520
1.25
4.40
.545
LIFT COEFFICIENT - C_L
DRAG COEFFICIENT - C_D
ANGLE OF ATTACK

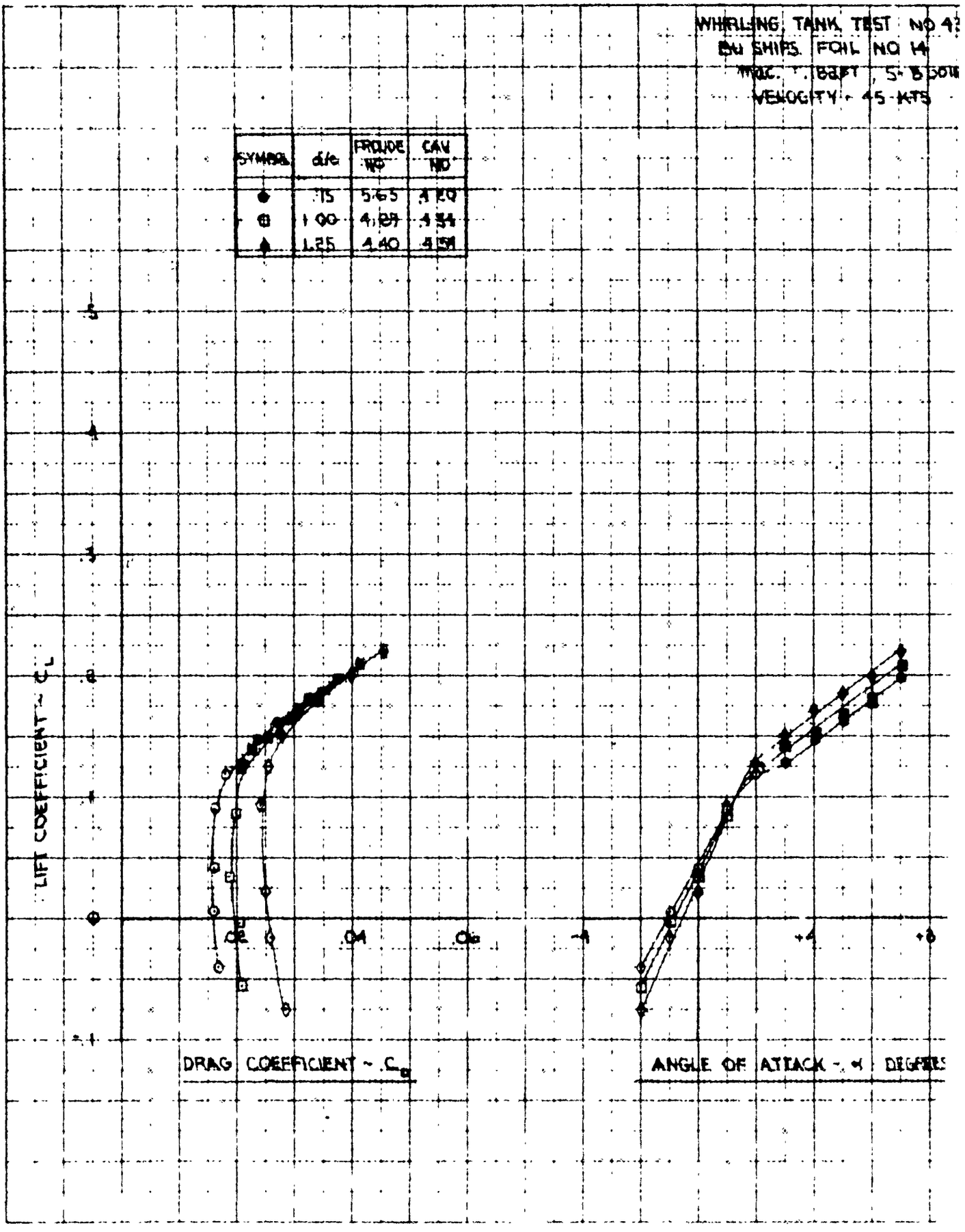
TEST NO 43
L NO. 14
FT, S = 8.00 IN²
= 40 KTS

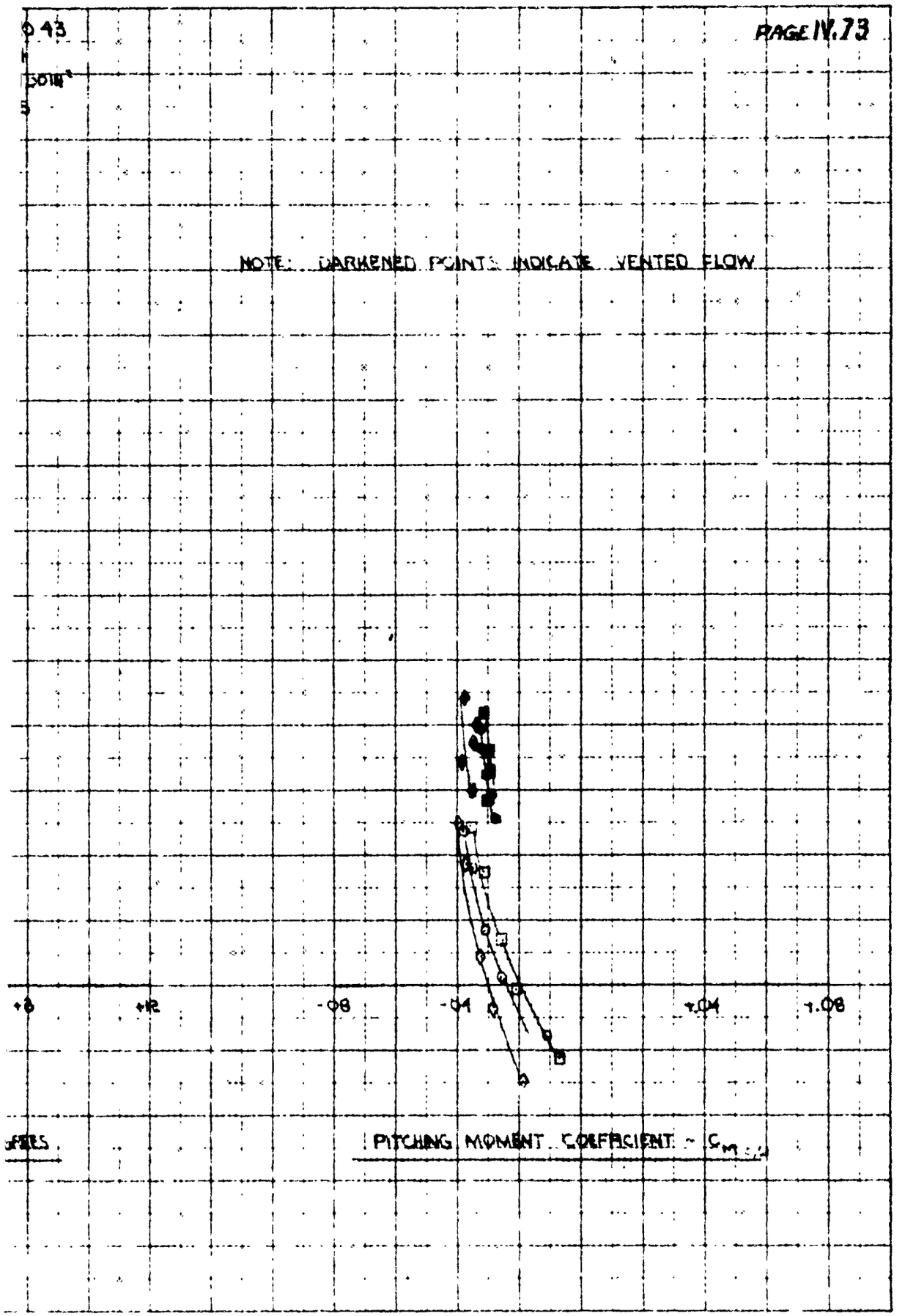
NOTE DARKENED POINTS INDICATE VENTED FLOW

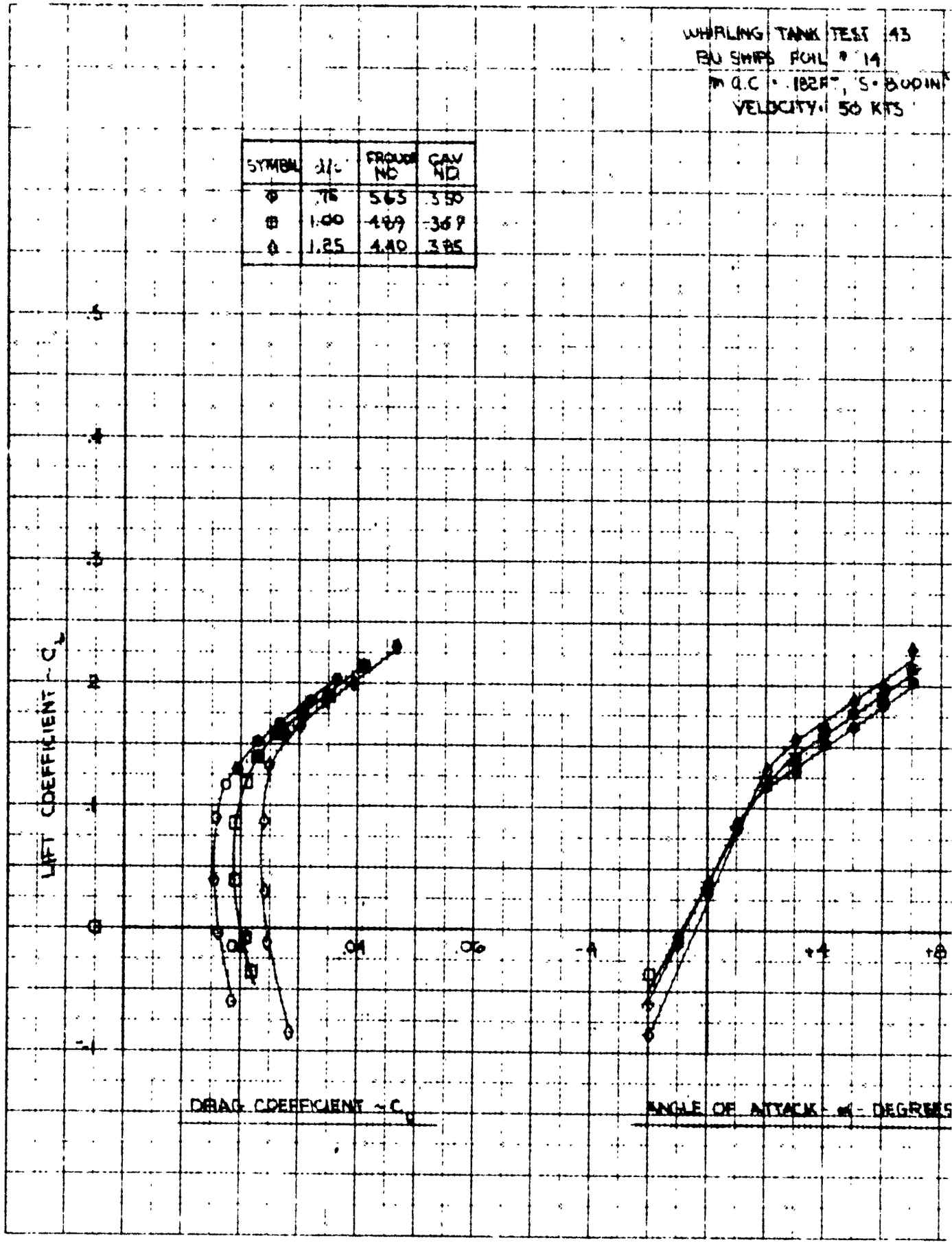


K, α DEGREES

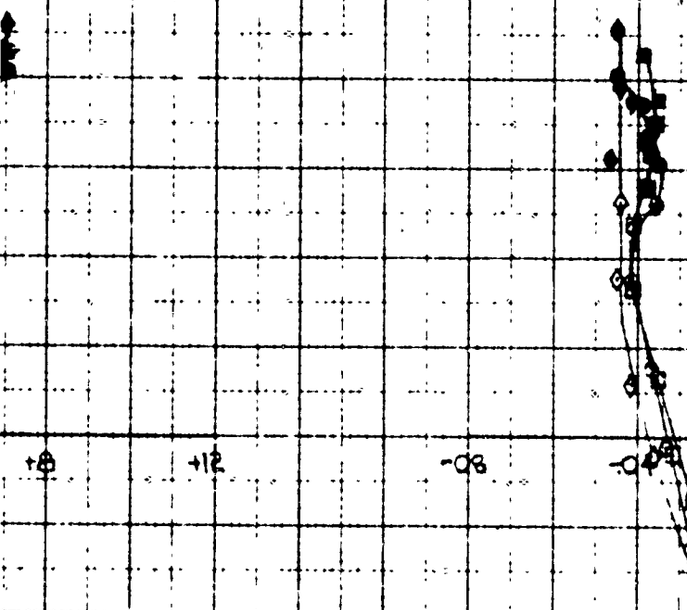
PITCHING MOMENT COEFFICIENT : $C_{m_{c/4}}$


WHIRLING TANK TEST NO 4
BU SHIPS FOIL NO 14
VELOCITY - 45 KTS
SYMBOL
d/c
FROUDE NO
CAV NO
.15
5.65
1.00
4.07
1.25
4.40
LIFT COEFFICIENT ~ C_L
DRAG COEFFICIENT ~ C_D
ANGLE OF ATTACK ~ α DEGREES


0.43
NOTE: DARKENED POINTS INDICATE VENTED FLOW
+.08
-.08
-.04
+.04
1.08
PITCHING MOMENT COEFFICIENT ~ C_m


WHIRLING TANK TEST 43
BU SHIPS FOIL # 14
m a.c = .182FT, S = 8.00 IN²
VELOCITY = 50 KTS
SYMBOL
FROUDE NO
CAV NO
.75
5.63
.350
1.00
4.89
.369
1.25
4.40
.385
LIFT COEFFICIENT ~ C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-4
+4
+8
DRAG COEFFICIENT ~ C_D
ANGLE OF ATTACK ~ α ~ DEGREES

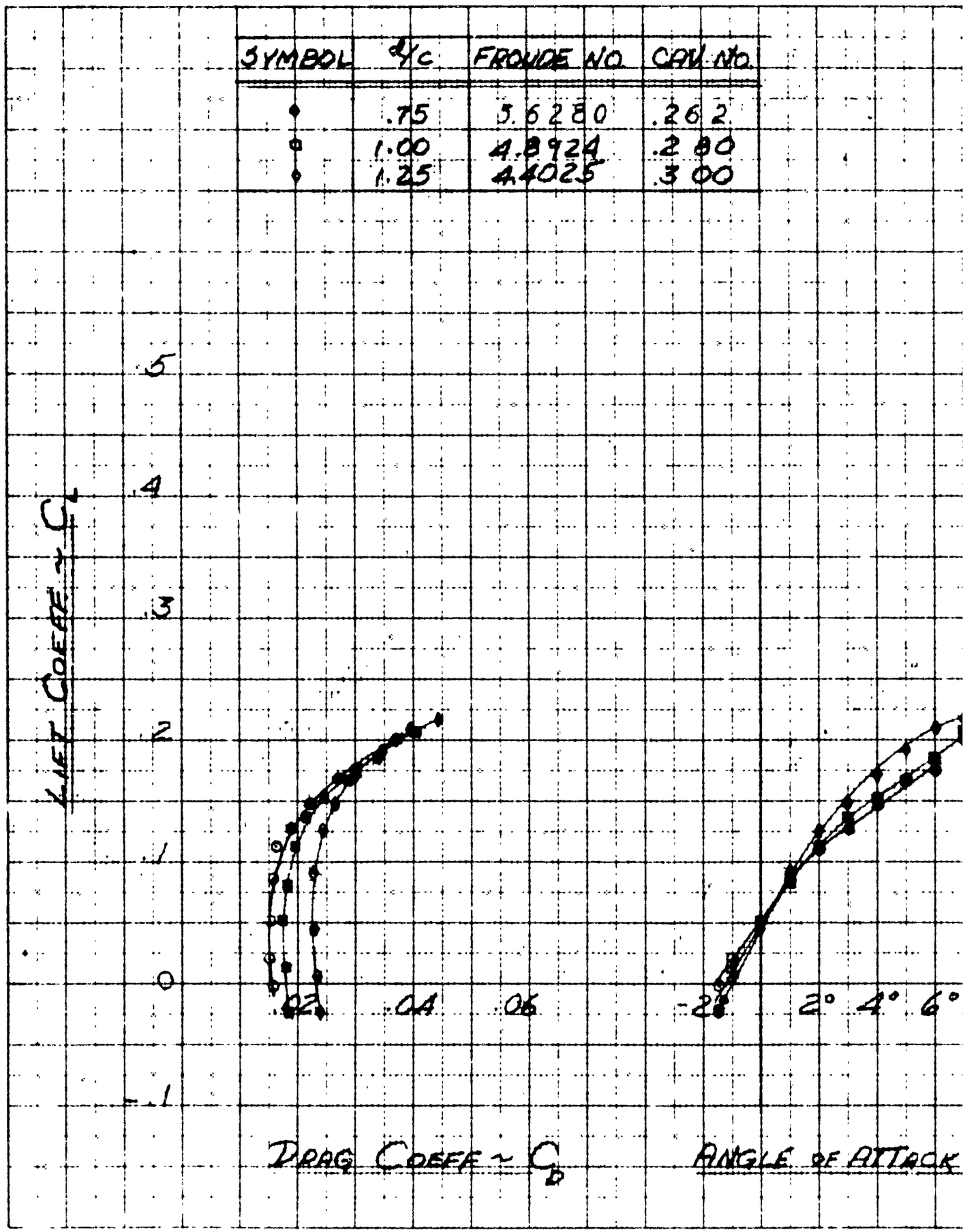
NOTE DASHED POINTS INDICATE VENTED FLOW

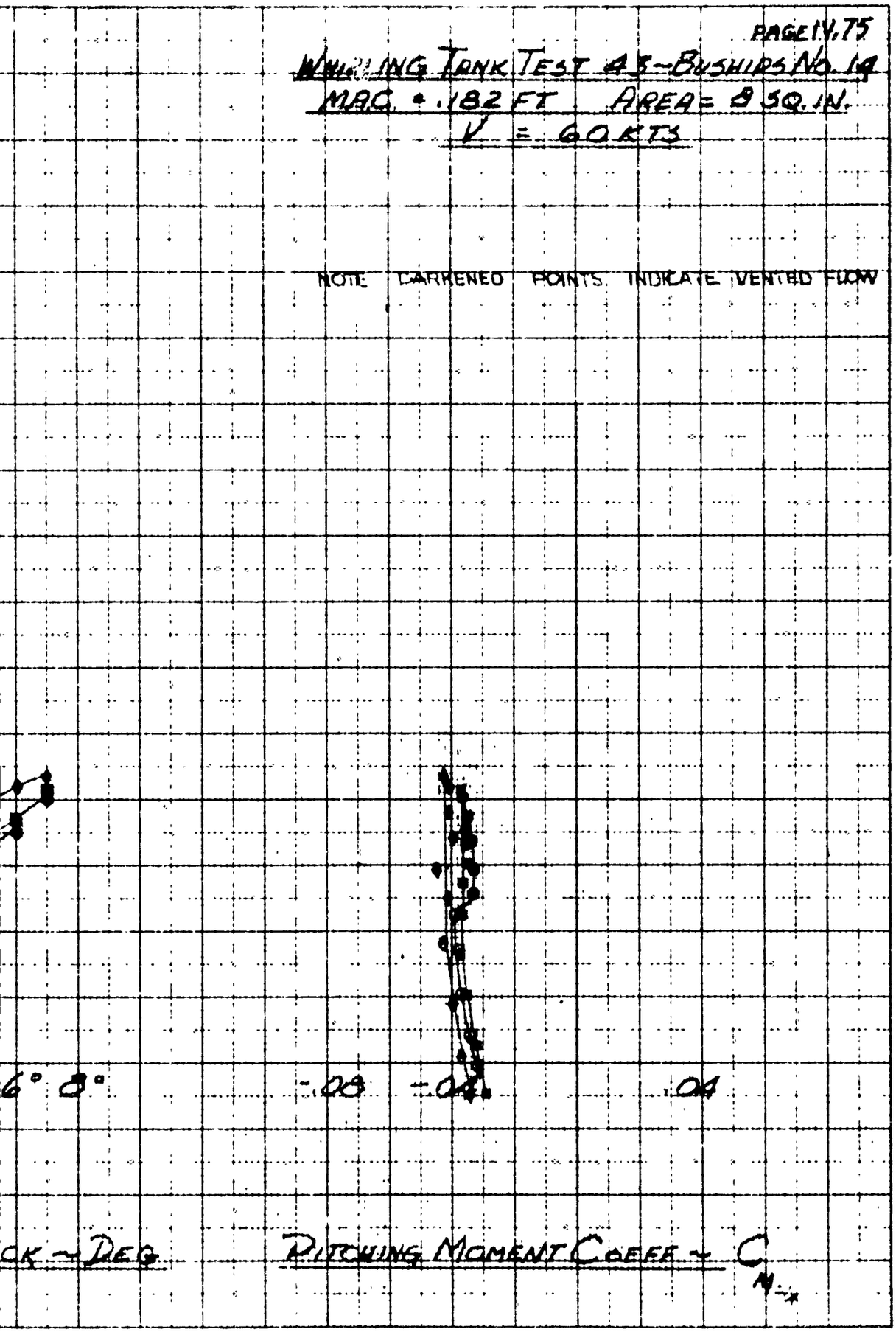


+.08 +.12 -.08 -.04 +.04 +.08

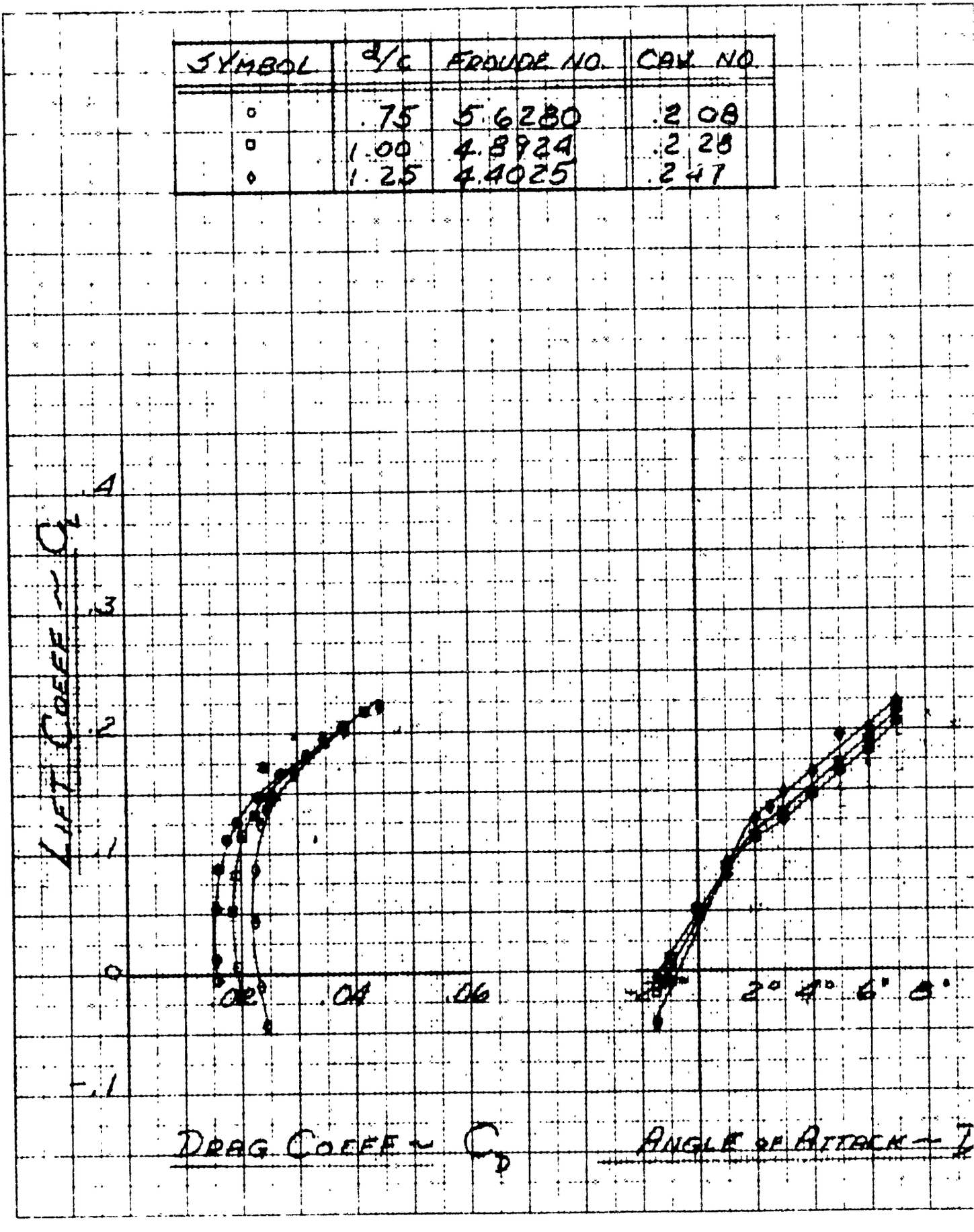
PITCHING MOMENT COEFFICIENT ~ C_m

SYMBOL	d/c	FROUDE NO.	CAV NO.
◆	.75	3.6280	.262
○	1.00	4.8924	.280
◆	1.25	4.4025	.300



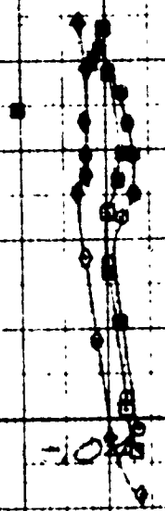

PAGE IV.75
WHIRLING TANK TEST 43 - BUSHIPS NO. 14
MAC = .182 FT AREA = 8 SQ. IN.
V = 60 KTS
NOTE: DARKENED POINTS INDICATE VENTED FLOW
6° 8°
-.08
-.04
.04
CK ~ DEG
PITCHING MOMENT COEFF ~ $C_{M_{-x}}$

SYMBOL	d/c	FROUDE NO.	CAV NO.
○	.75	5.6280	.208
□	1.00	4.8924	.228
◇	1.25	4.4025	.247



WHIRLING TANK TEST #3 ~ BUSHIPS NO 14
M.A.C. = .182 FT. ~ AREA = 9 SQ. IN.
V = 70 KTS

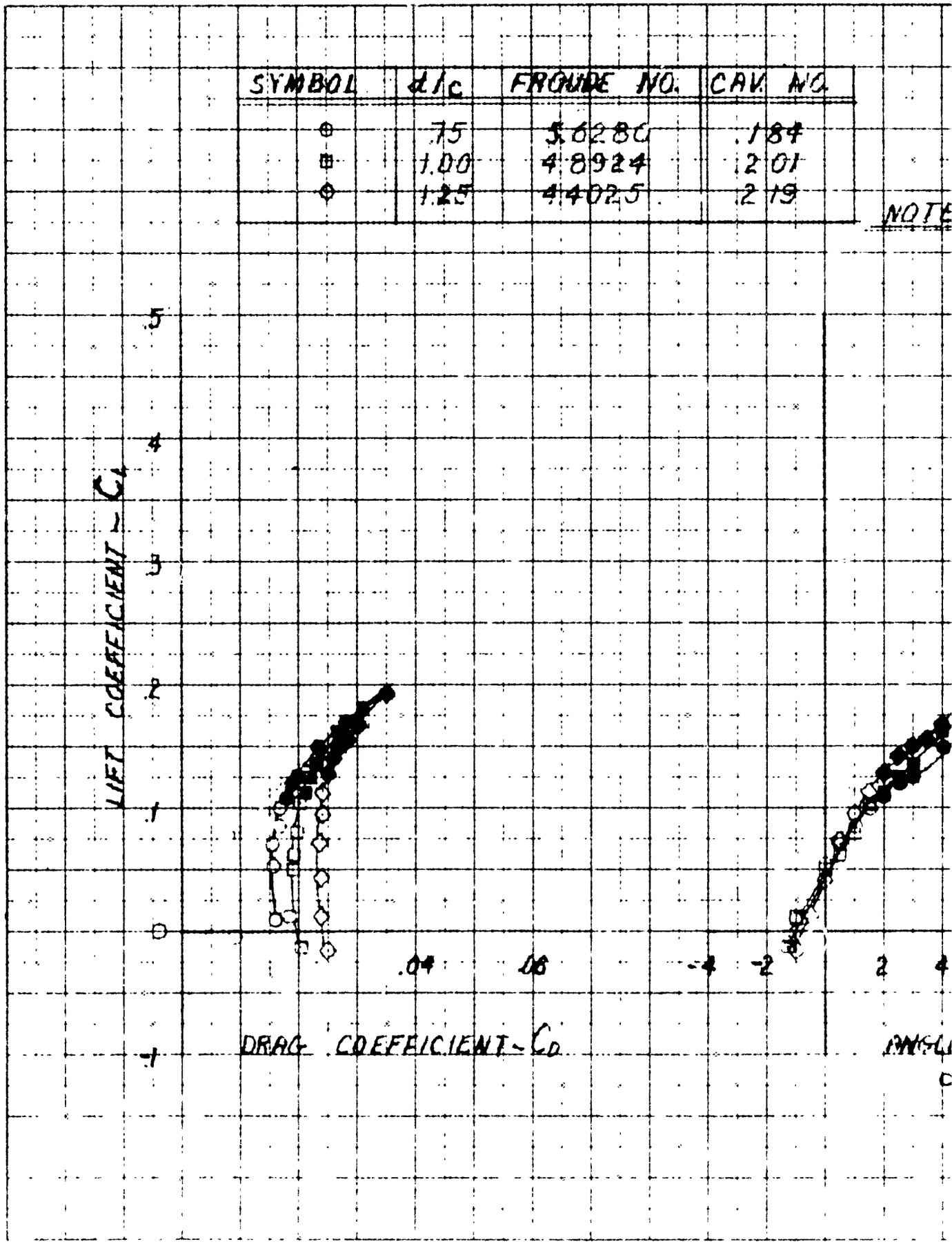
NOTE. DARKENED POINTS INDICATE VENTED FLOW



-.08 -.10 .04

- DEG

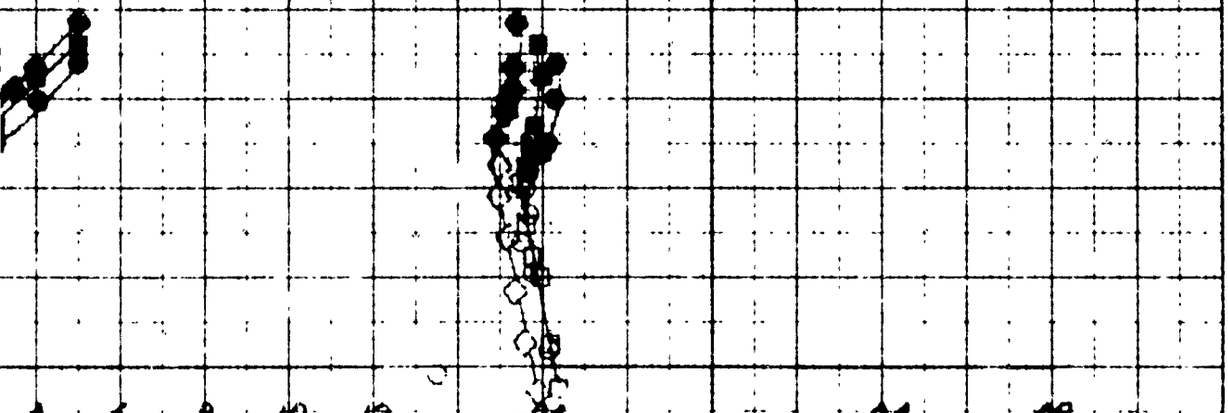
PITCHING MOMENT COEFF ~ C_m


SYMBOL
d/c
FROUDE NO.
CAV. NO.
.75
5.6280
.184
1.00
4.8924
.201
1.25
4.4025
.219
NOTE
LIFT COEFFICIENT - C_L
DRAG COEFFICIENT - C_D
.04
.06
-4
-2
2
4
5
4
3
2
1
0
-1

WHIRLING TANK TEST NO. 43
FOIL NO. 14 MAC = 0.182 FT.
AREA = 8.00 SQ IN.

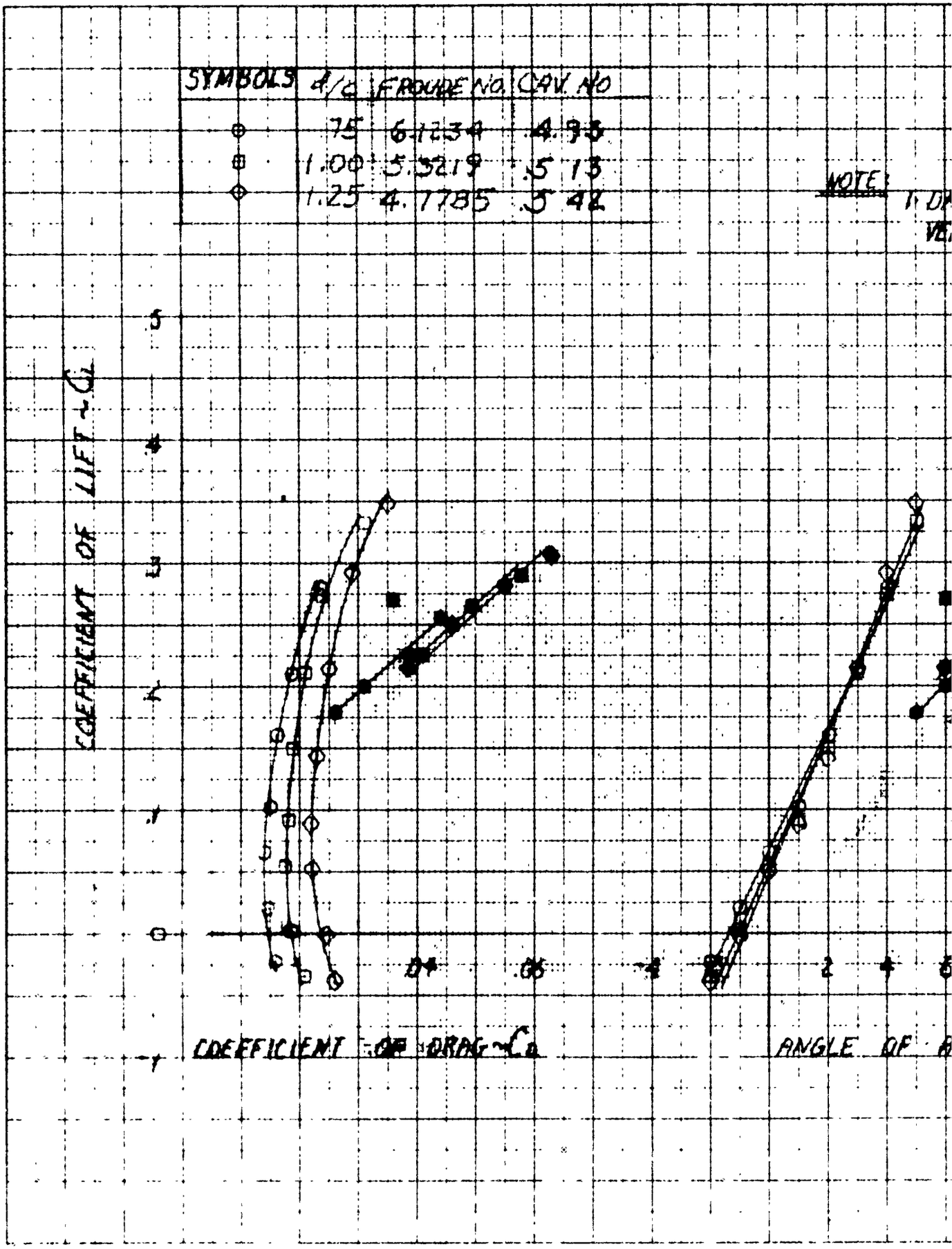
V = 80 KTS.

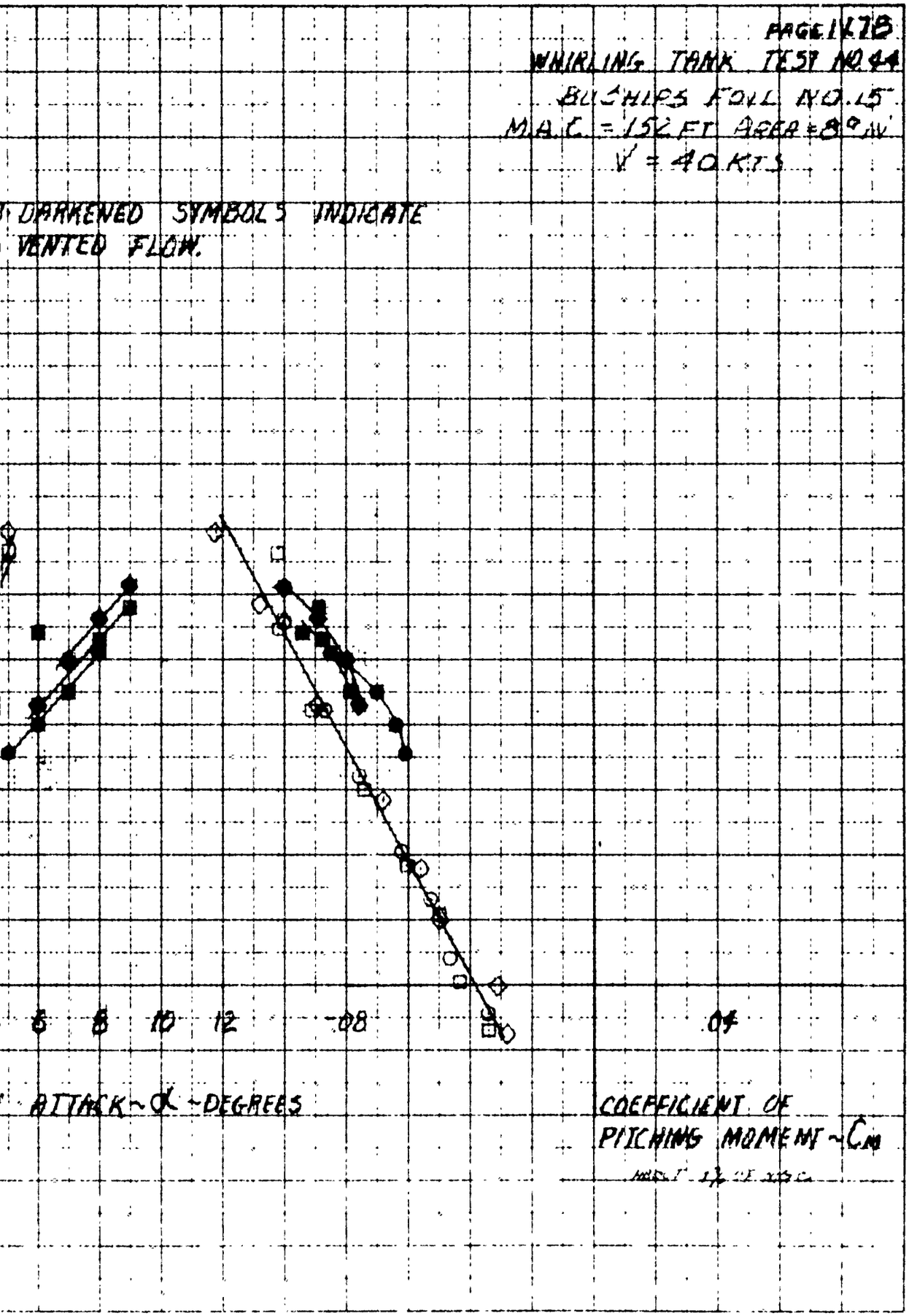
TE:
1 DARKENED SYMBOLS
INDICATE VENTED FLOW.

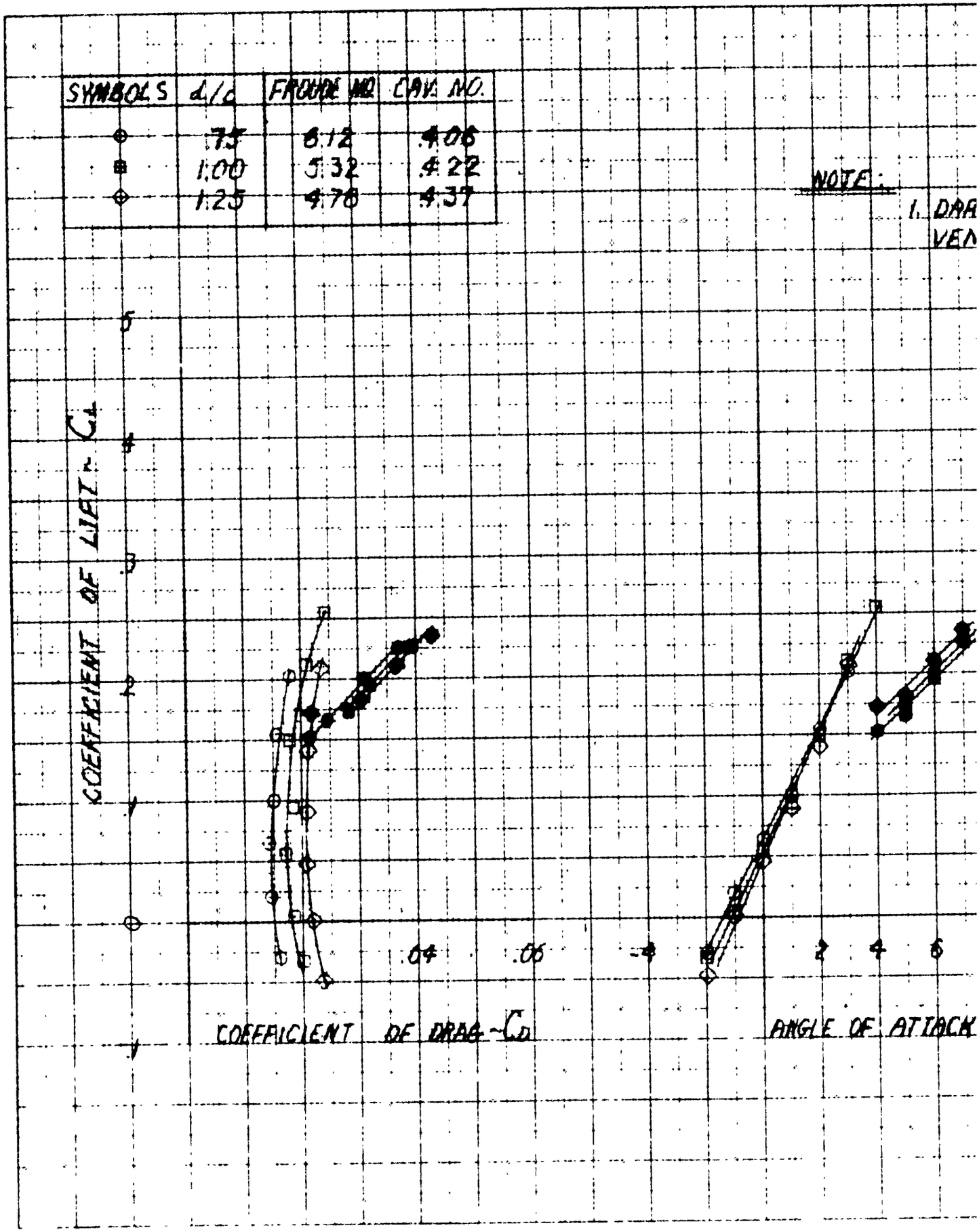


GLE OF ATTACK
α ~ DEGREES

PITCHING MOMENT
COEFFICIENT ~ $C_{M_{c/4}}$

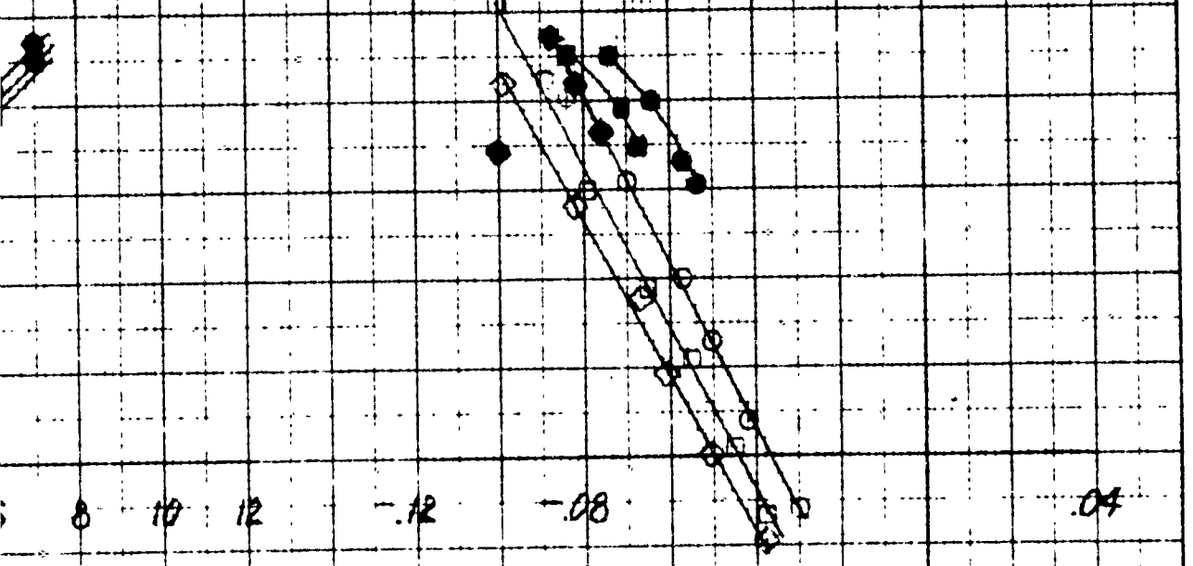

SYMBOLS
A/C
FROUDE NO
CAV NO
.75
6.1234
.495
1.00
5.5219
.515
1.25
4.7785
.542
NOTE:
COEFFICIENT OF LIFT ~ C_L
COEFFICIENT OF DRAG ~ C_D
ANGLE OF


PAGE IV.7B
WHIRLING TANK TEST NO.44
BUSHIPS FOIL NO.15
M.A.C. = 152 FT AREA = 8° AV
V = 40 KTS
DARKENED SYMBOLS INDICATE
VENTED FLOW.
6
8
10
12
-.08
.04
ATTACK ~ α ~ DEGREES
COEFFICIENT OF
PITCHING MOMENT ~ C_M


SYMBOLS
d/c
FROUDE NO.
CAV. NO.
.75
6.12
.406
1.00
5.32
.422
1.25
4.78
.437
NOTE:
1. DRA
VEN
COEFFICIENT OF LIFT - C_L
.6
.4
.2
0
-.2
.04
.06
-4
2
4
6
COEFFICIENT OF DRAG - C_D
ANGLE OF ATTACK

WHIRLING TANK TEST NO. 44
BU SHIPS FOIL NO. 15
MAC. = .152 FT AREA = 8.00 SQ IN.
V = 45 KTS.

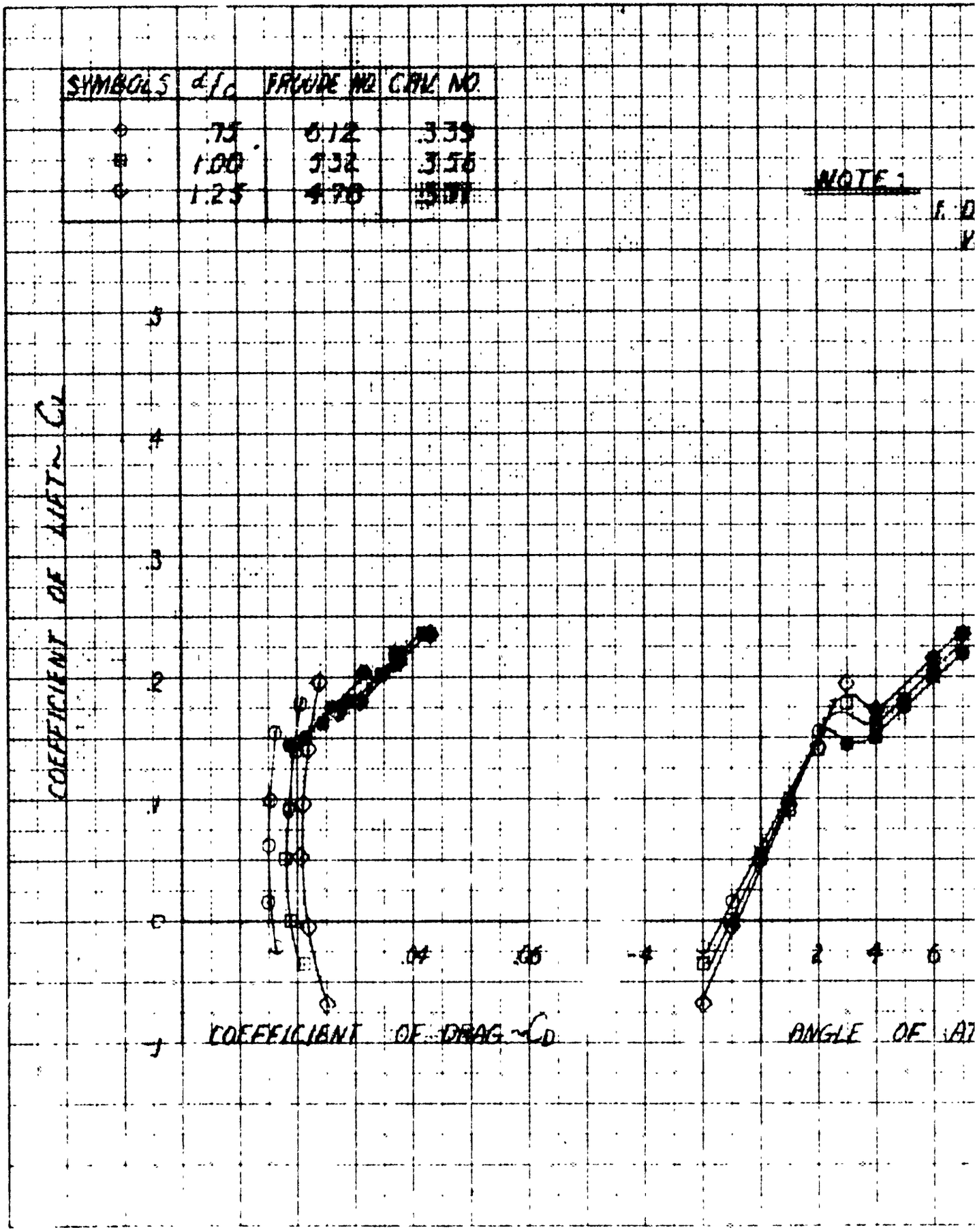
DARKENED SYMBOLS INDICATE
VENTED FLOW.



8 10 12 -.12 -.08 .04

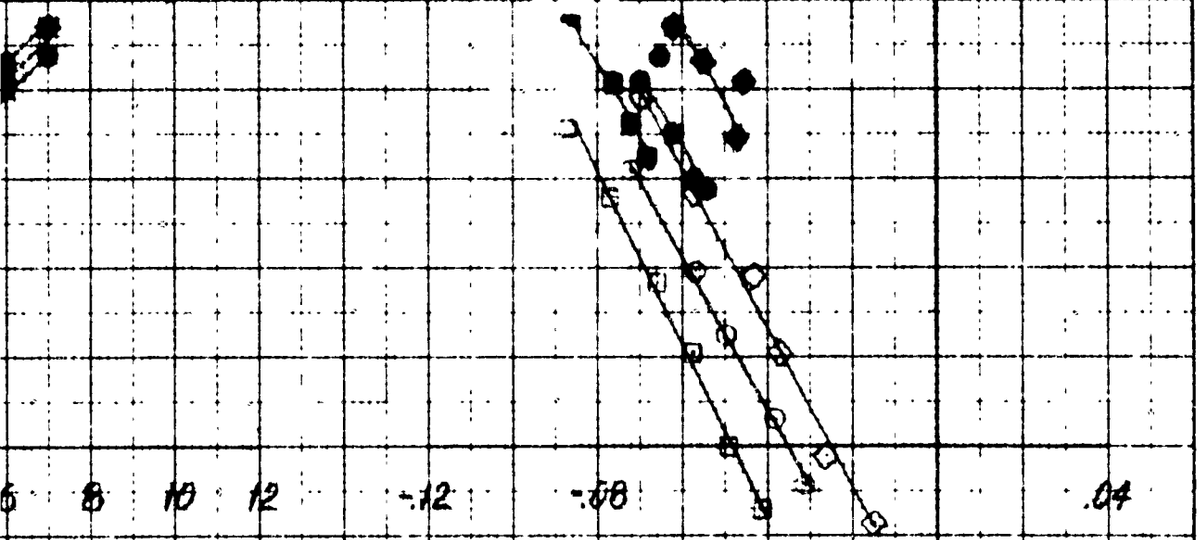
ACK-α-DEGREES

COEFFICIENT OF
PITCHING MOMENT ~ C_M about ¼ pt of mac.


SYMBOLS
d/c
FROUDE NO.
CAV. NO.
.75
6.12
3.39
1.00
5.32
3.56
1.25
4.78
NOTE:
COEFFICIENT OF LIFT ~ C_L
.5
.4
.3
.2
.1
0
-.1
.04
.06
-4
2
4
6
COEFFICIENT OF DRAG ~ C_D
ANGLE OF AT

WHIRLING TANK TEST NO. 44
BU SHIPS FOIL NO 15
MAC = 1.52 FT. AREA = 8.00 SQ FT.
V = 50 KTS.

E DARKENED SYMBOLS INDICATE
VENTED FLOW



6 8 10 12 -.12 -.08 .04

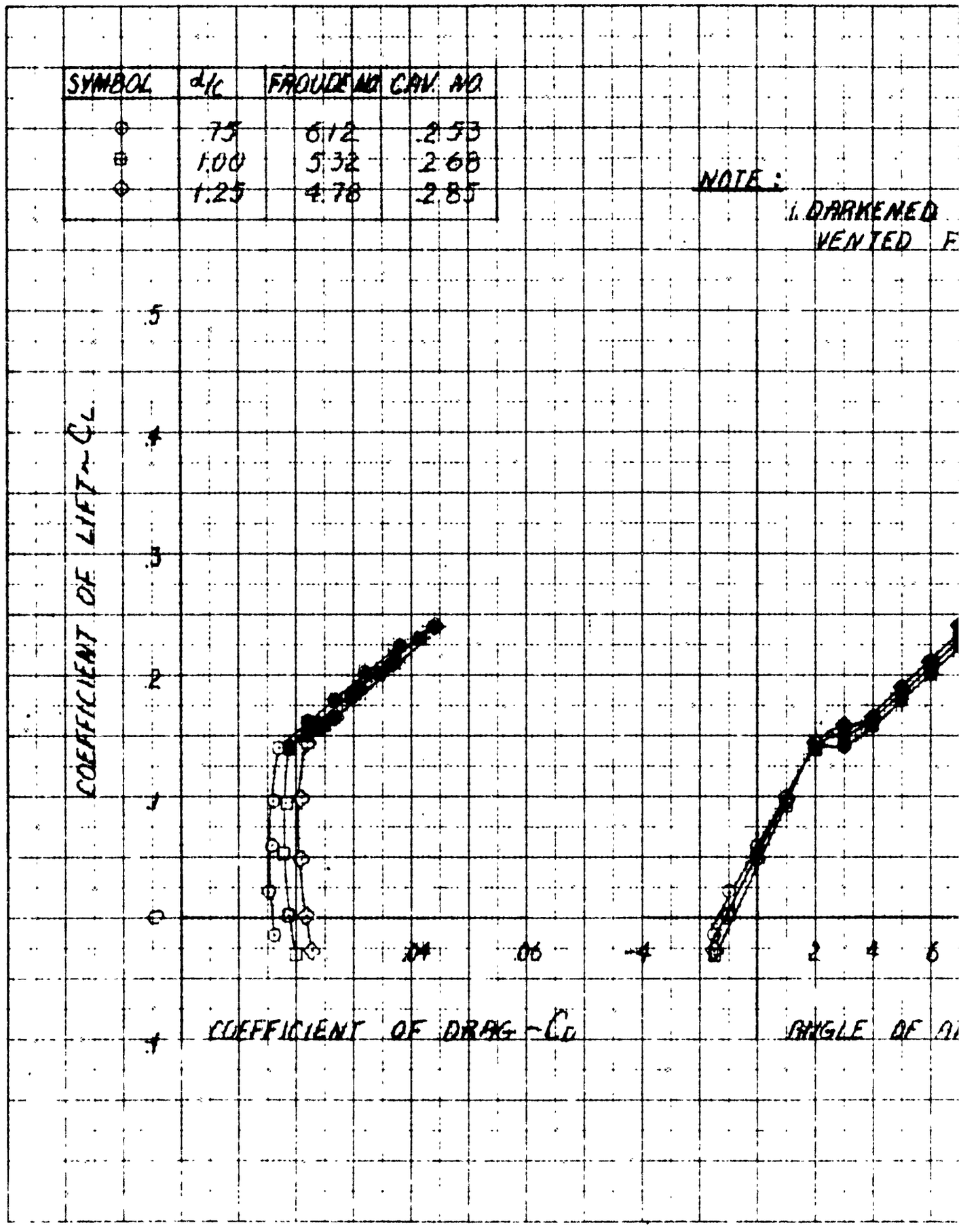
ATTACK ANGLE - α - DEGREES

COEFFICIENT OF
PITCHING MOMENT - C_M about 25% of MAC

SYMBOL	d/c	FROUDE NO	CAV. NO
⊕	.75	6.12	.253
⊕	1.00	5.32	.268
⊕	1.25	4.78	.285

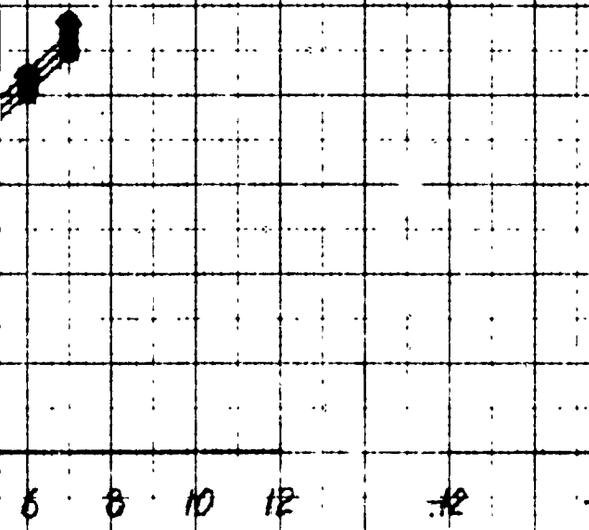
NOTE :

1. DARKENED
VENTED F



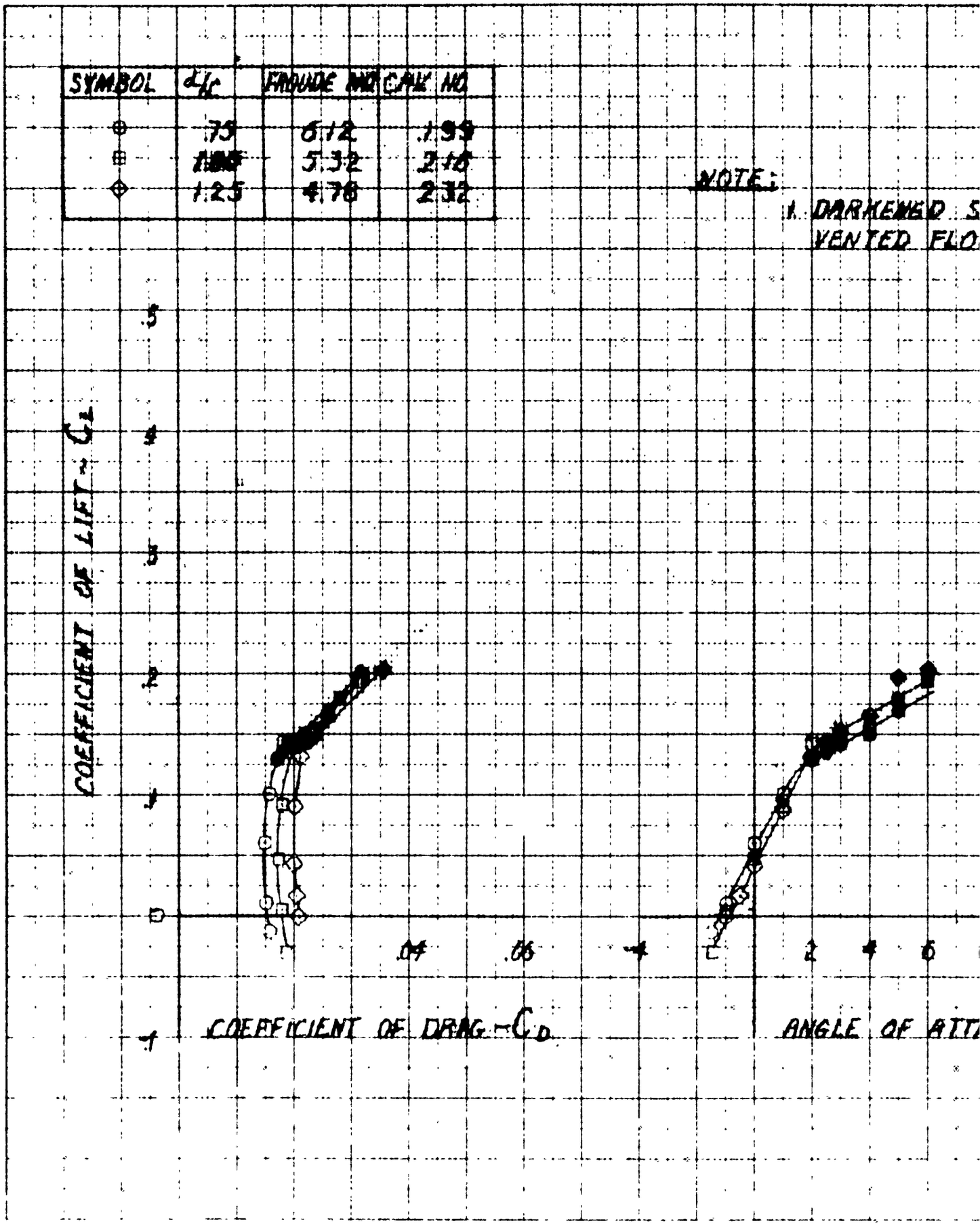
WHIRLING TANK TEST NO. 44
BU SHIPS FOIL NO. 15
MAC = .152 FT. AREA = 8.00 SQ IN
V = 60 KTS.

ED SYMBOLS INDICATE
FLOW



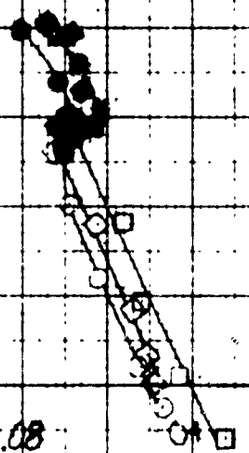
6 8 10 12 -.12 -.08 -.04

F ATTACK - α - DEGREES COEFFICIENT OF PITCHING MOMENT - $C_{M_{about\ 9\%\ of\ MAC}}$


SYMBOL
d/c
FROUDE NO
CAV NO
.75
6.12
.199
5.32
.216
1.25
4.78
2.32
NOTE:
1. DARKENED S
VENTED FLO
COEFFICIENT OF LIFT ~ C_L
.5
.4
.3
.2
.1
0
-.1
.04
.06
-4
2
4
6
COEFFICIENT OF DRAG ~ C_D
ANGLE OF ATT

WHIRLING TANK TEST NO. 44
BU SHIPS FOIL NO. 15
MAC = 1.52 FT. AREA = 8.00 SQ. FT.
V = 70 KTS.

? SYMBOLS INDICATE
FLOW.



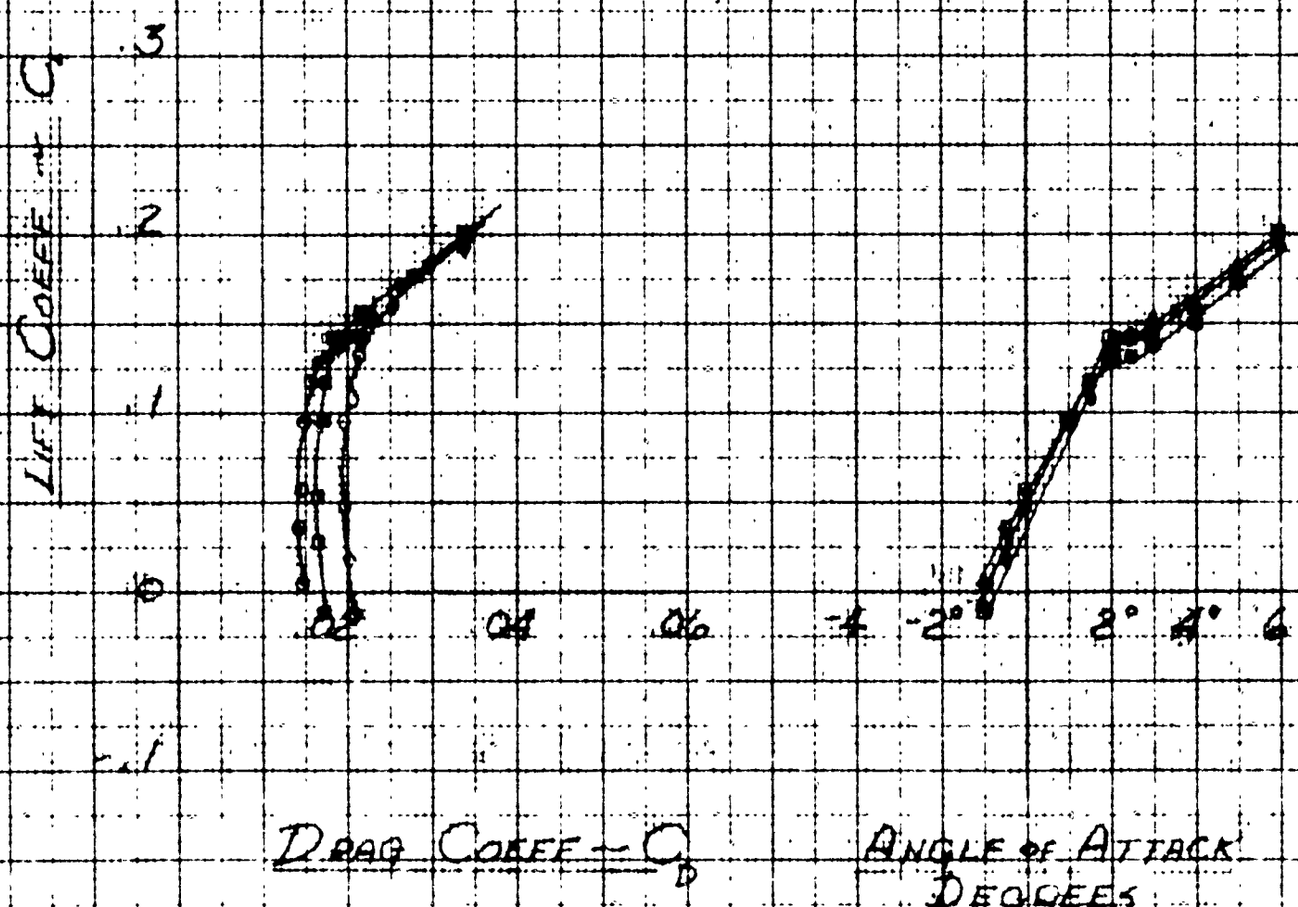
8 10 12 -.12 -.08 04

ATTACK - α - DEGREES

COEFFICIENT OF
PITCHING MOMENT - $C_{M_{about\ 25\%\ of\ MAC}}$

SYMBOL	ℓ/c	FROUDE NO	CAV NO
○	.75	6.1234	1.739
□	1.00	5.3219	1.938
◇	1.25	4.7785	2.092

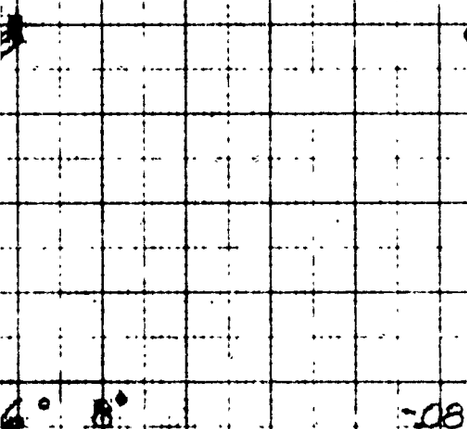
NOTE:
1. DARKENED S
INDICATE VE
FLOW



WHIRLING TANK TEST NO 44
BUSHIPS FOIL NO 15
M A C = .152 FT AREA = 8 SQ IN.

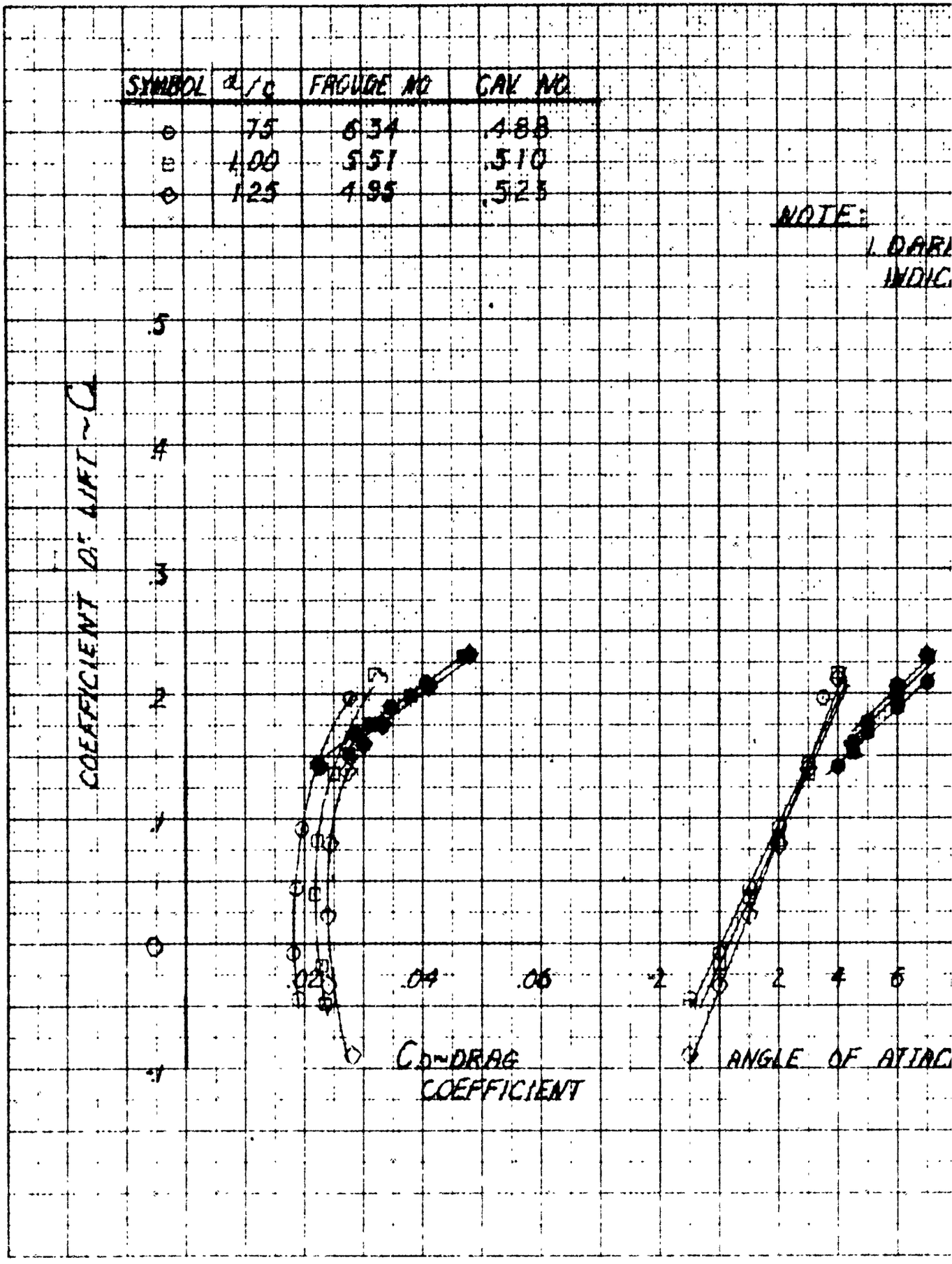
V = 80 KTS

SYMBOLS
VENTED



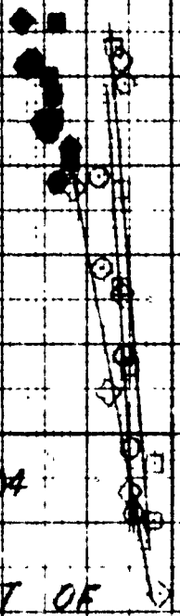
4° 8° -.08 -.04 .04

PITCHING MOMENT COEFF - C_M
ABOUT 1/4 OF THE MAC


SYMBOL
α/c
FROUDE NO
CAV NO
.75
6.34
.488
1.00
5.51
.510
1.25
4.95
.525
NOTE:
COEFFICIENT OF LIFT ~ C_L
C_D ~ DRAG COEFFICIENT
ANGLE OF ATTAC

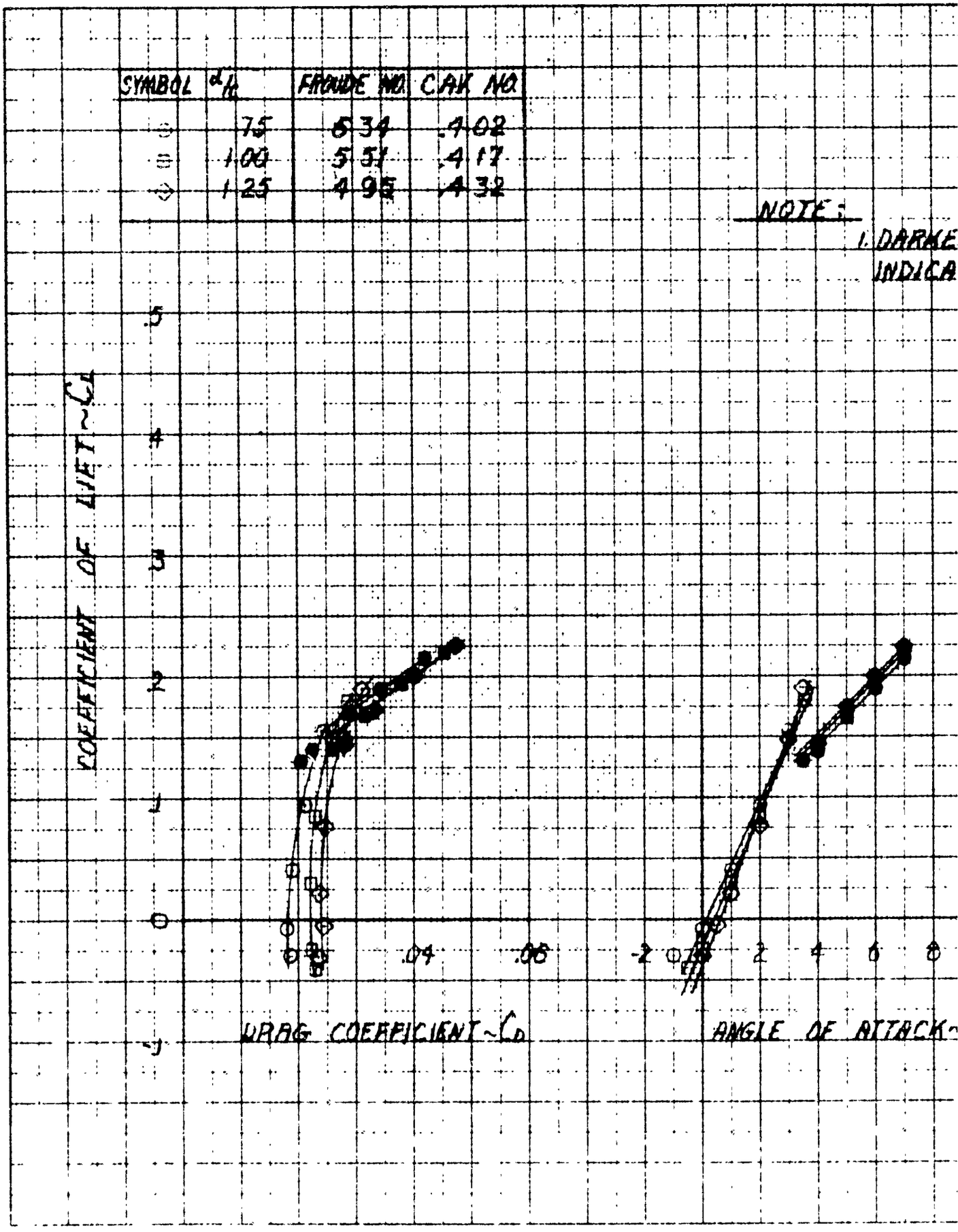
WHIRLING TANK TEST NO 46
BU SHIPS FOIL NO 16
M.A.C. = .142 FT AREA = 8.23 IN²
V = 40 KTS

ARKENED SYMBOLS
DICATE VENTED FLOW



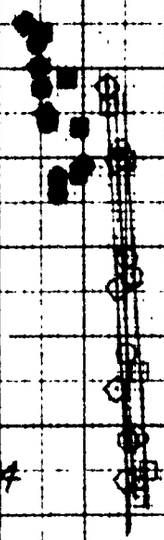
8 10 12 -.08 -.04 .04

ACK - α DEGREES COEFFICIENT OF PITCHING MOMENT - $C_{M_{c/4}}$


SYMBOL
FROUDE NO.
CAV NO.
.75
6.34
.402
1.00
5.51
.417
1.25
4.95
.432
NOTE:
1. DARKE
INDICA
COEFFICIENT OF LIFT ~ C_L
.5
.4
.3
.2
.1
0
-.1
.04
.08
-2
2
4
6
8
DRAG COEFFICIENT ~ C_D
ANGLE OF ATTACK ~

WHIRLING TANK TEST NO 46
BU SHIPS FOIL NO. 16
MAC = .142 FT AREA = 8.23 IN²
V = 45 KTS

KENED SYMBOLS
CATE VENTED FLOW.



8 10 12 .08 .04 .04

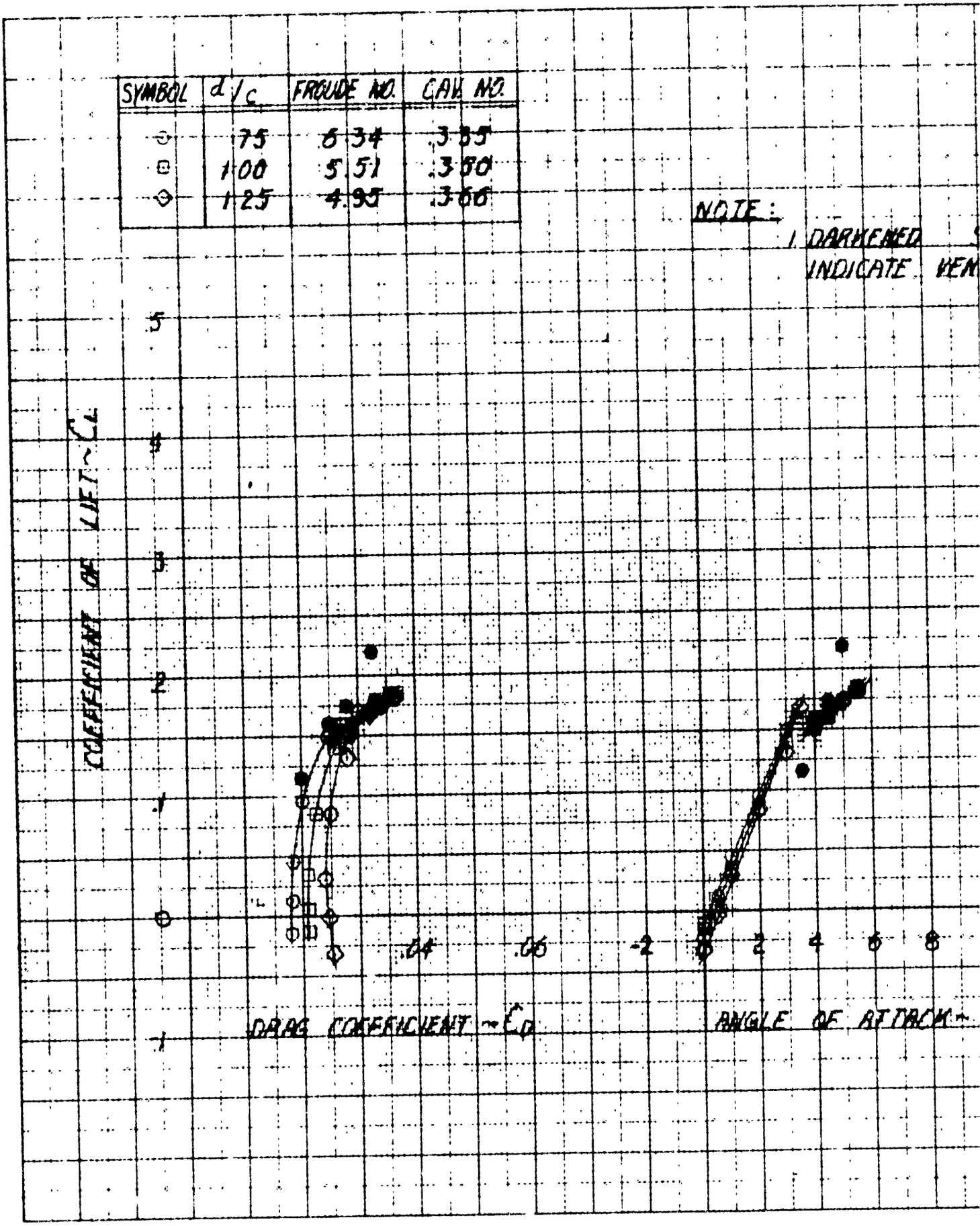
K ~ α - DEGREES

COEFFICIENT OF
PITCHING MOMENT ~ $C_{M_{c/4}}$

SYMBOL	d/c	FROUDE NO.	CAV. NO.
◇	.75	6.34	.385
□	1.00	5.51	.380
◇	1.25	4.95	.366

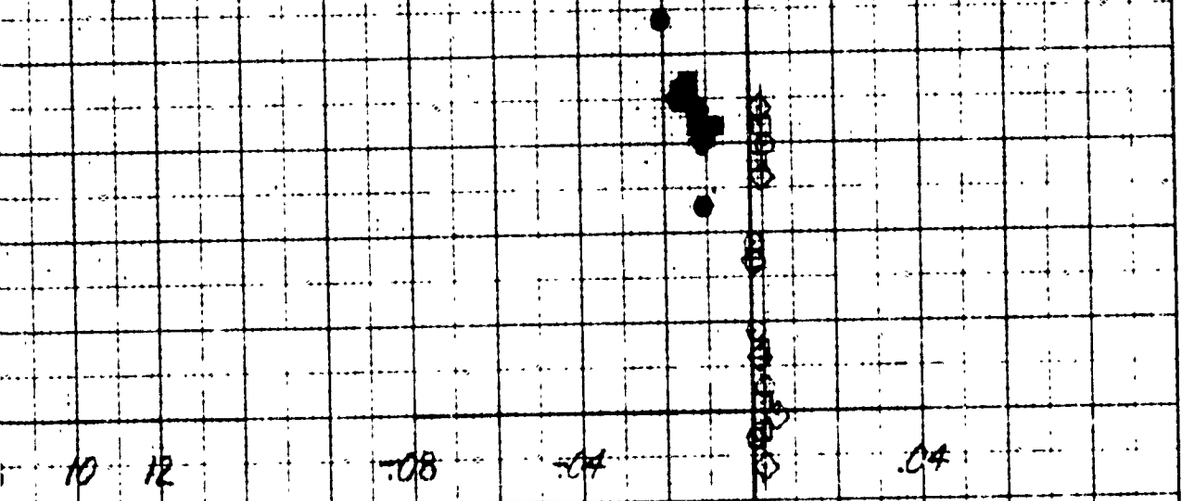
NOTE:
1. DARKENED

INDICATE VEN



WHIRLING TANK TEST NO. 46
BU SHIPS FOIL NO. 16
MAC. = .142 FT. AREA = 8.23 IN²
V = 50 KTS.

SYMBOLS
VENTED FLOW



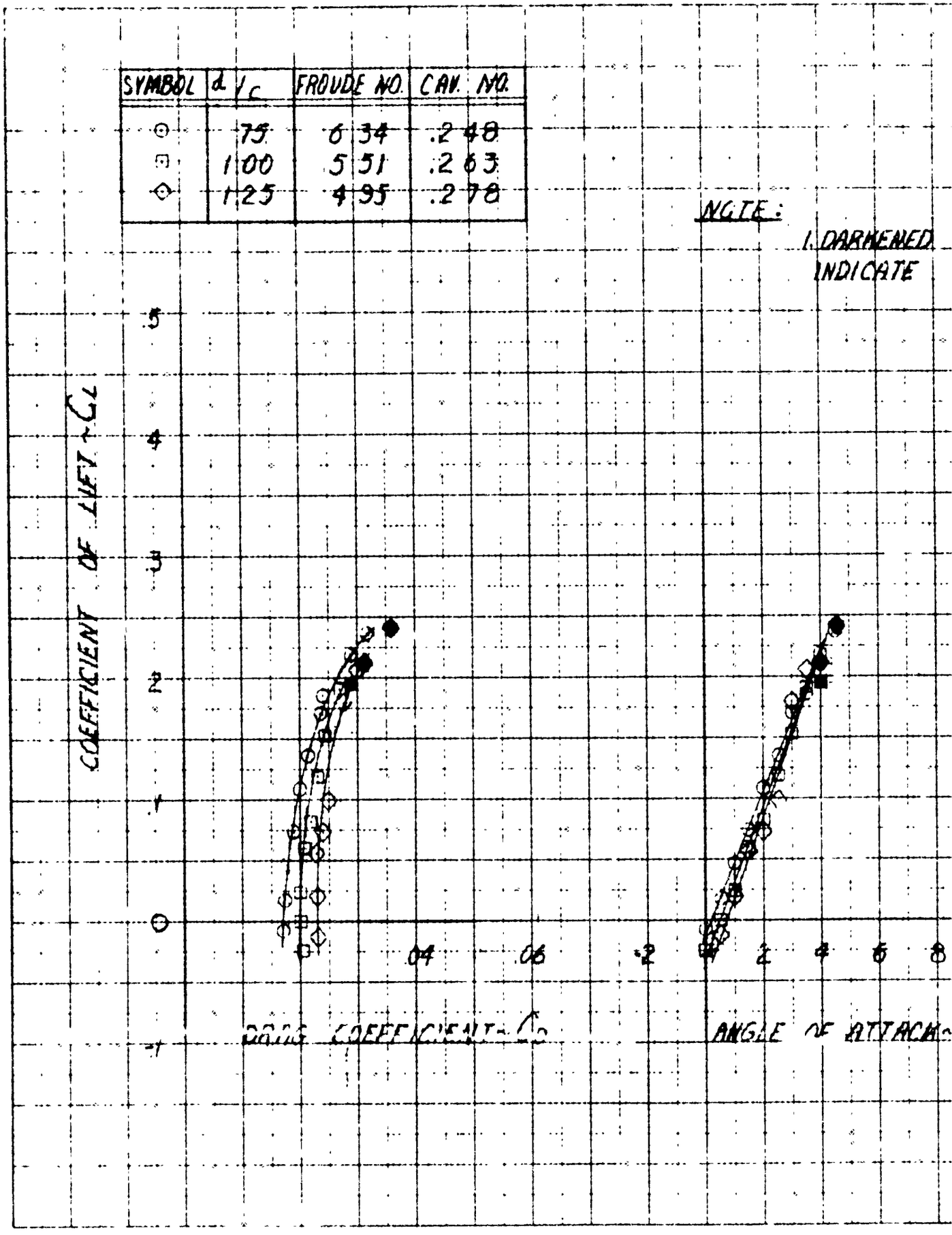
α - DEGREES

COEFFICIENT OF PITCHING MOMENT $C_{M_{C/4}}$

SYMBOL	d/c	FROUDE NO.	CAV. NO.
⊙	.75	6.34	.248
□	1.00	5.51	.263
◇	1.25	4.95	.278

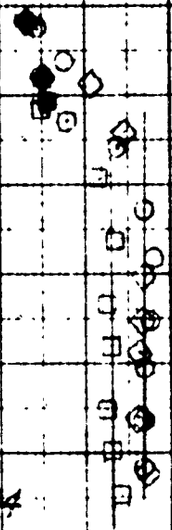
NOTE:

1. DARKENED INDICATE



WHIRLING TANK TEST NO. 46
BU SHIPS FOIL NO. 16
M.A.C. = 1.42 FT. AREA = 8.23 IN²
V = 66 KTS.

ED SYMBOLS
F VENTED FLOW



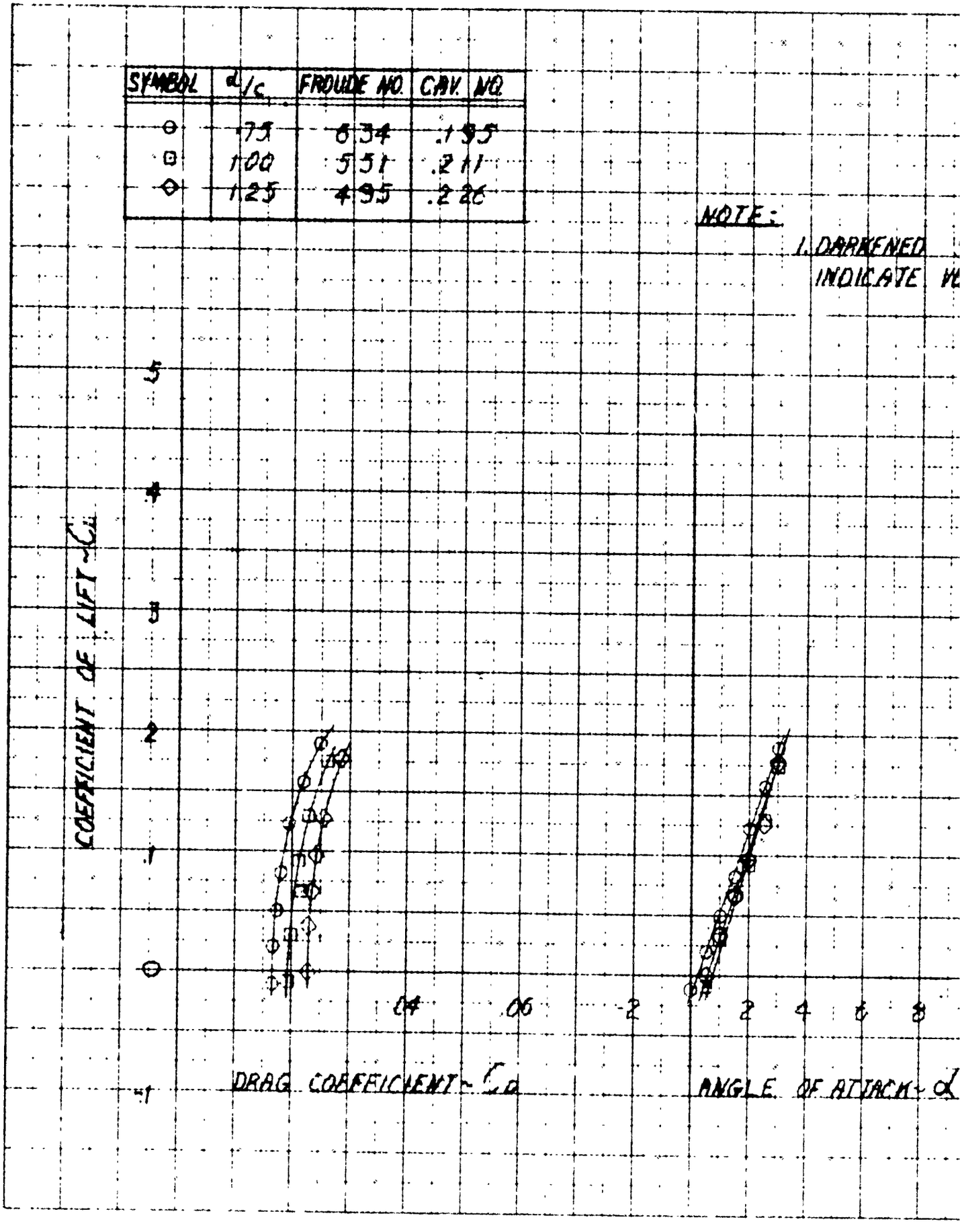
8 10 12 -.08 -.04 .04

CM ~ α - DEGREES

COEFFICIENT OF
PITCHING MOMENT - $C_{M_{c/4}}$

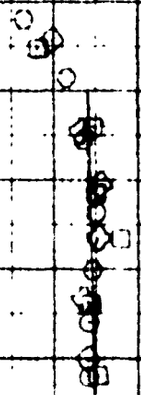
SYMBOL	d/c	FROUDE NO.	CAV. NO.
○	.75	6.34	.195
□	1.00	5.51	.211
◇	1.25	4.95	.226

NOTE:
1. DARKENED
INDICATE W



WHIRLING TANK TEST NO. 46
BU. SHIPS FOIL NO. 16
MAC = 1.42 FT. AREA = 8.23 IN²
V = 70 KTS.

SYMBOLS
VENTED FLOW



α - DEGREES COEFFICIENT OF PITCHING MOMENT - $C_{M_{1/4}}$

SYMBOL	d/c	FROUDE NO.	CAV NO
→	.75	~	~
□	1.00	5.51	.177
◇	1.25	4.95	.192

NOTE:
1. DARKENED
INDICATE

COEFFICIENT OF LIFT ~ C_L

5
4
3
2
1
0
-1

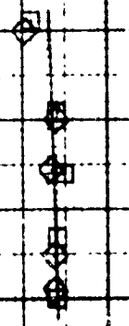
.04 .06 -2 2 4 6

DRAG COEFFICIENT ~ C_D

ANGLE OF ATTACK

WHIRLING TANK TEST NO. 46
BU SHIPS FOIL NO. 16
MAC = .142 FT. AREA = 8.23 IN²
V = 80 KTS.

SYMBOLS
VENTED FLOW.



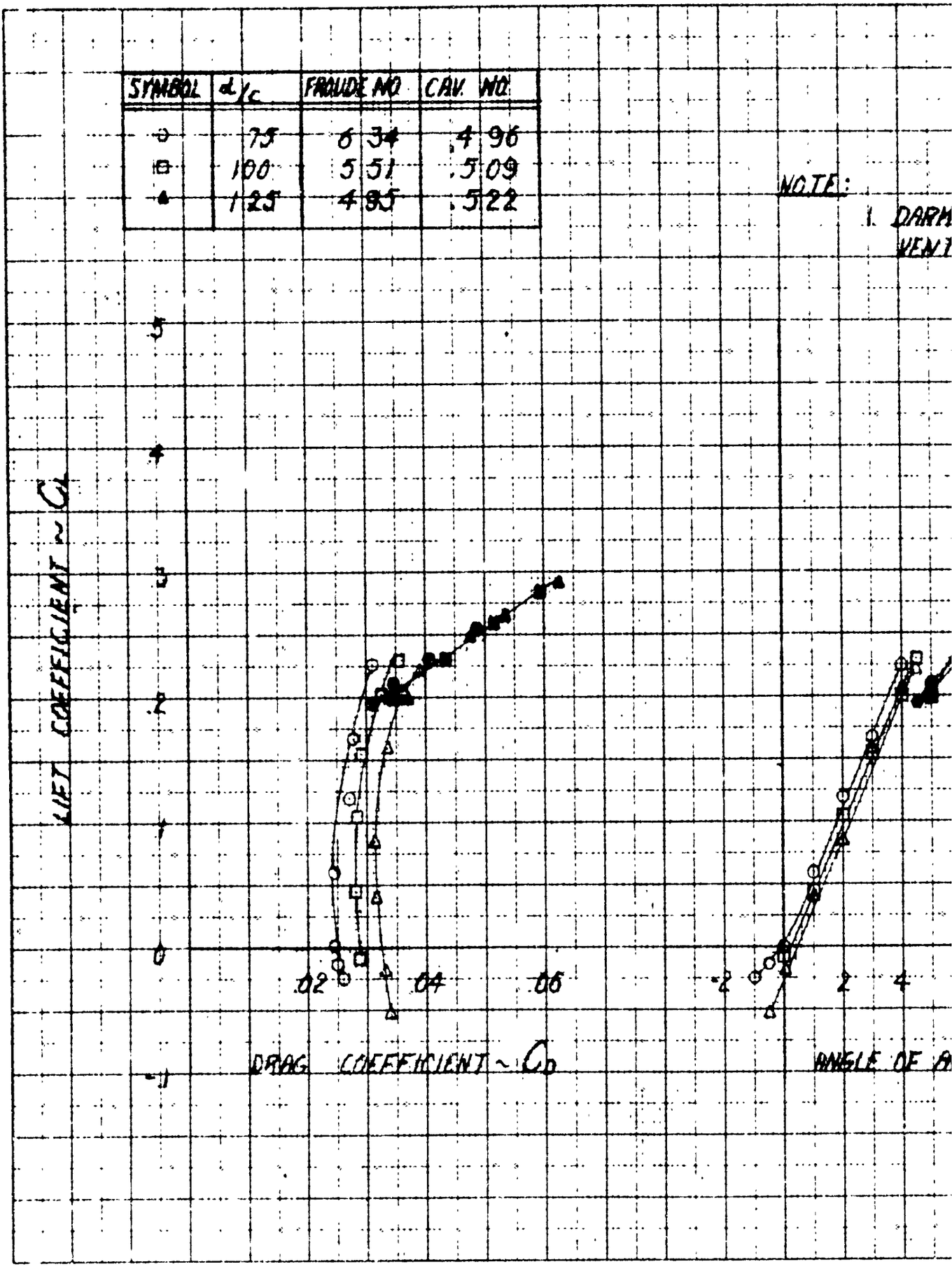
8 10 12 -.08 -.04 .04

M - α - DEGREES COEFFICIENT OF PITCHING MOMENT - $C_{M_{c/4}}$

SYMBOL	d/c	FROUDE NO	CAV. NO
○	.75	6.34	.496
□	1.00	5.51	.509
△	1.25	4.95	.522

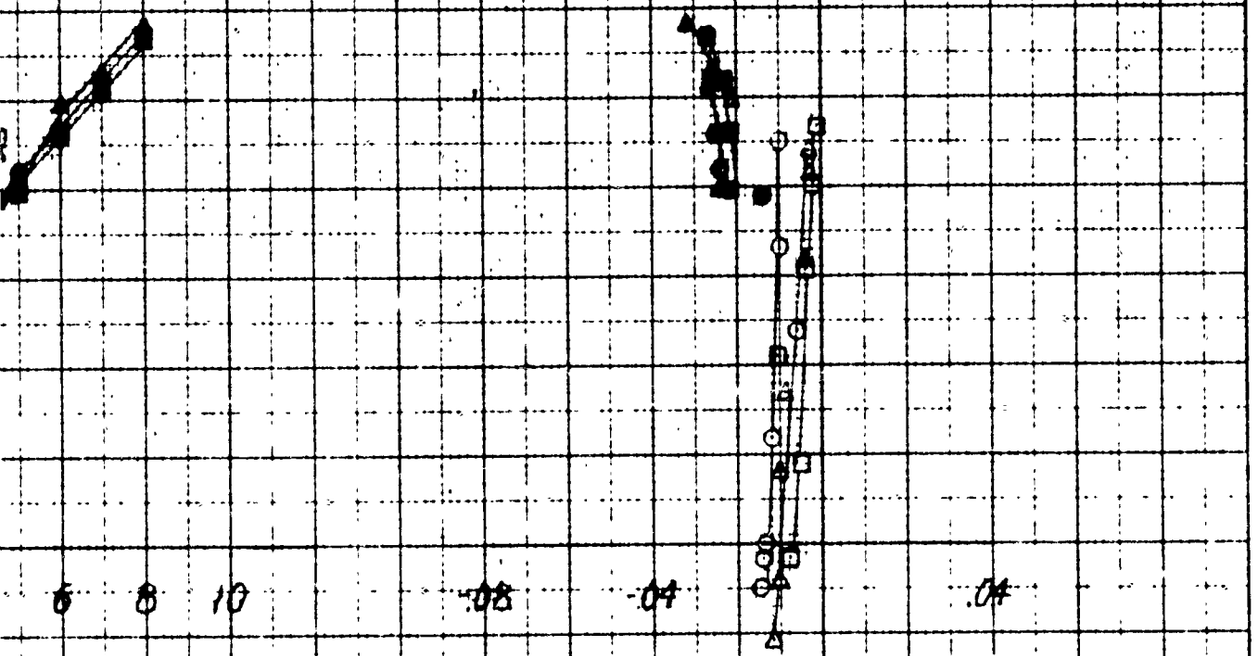
NOTE:

1. DARM
VENT

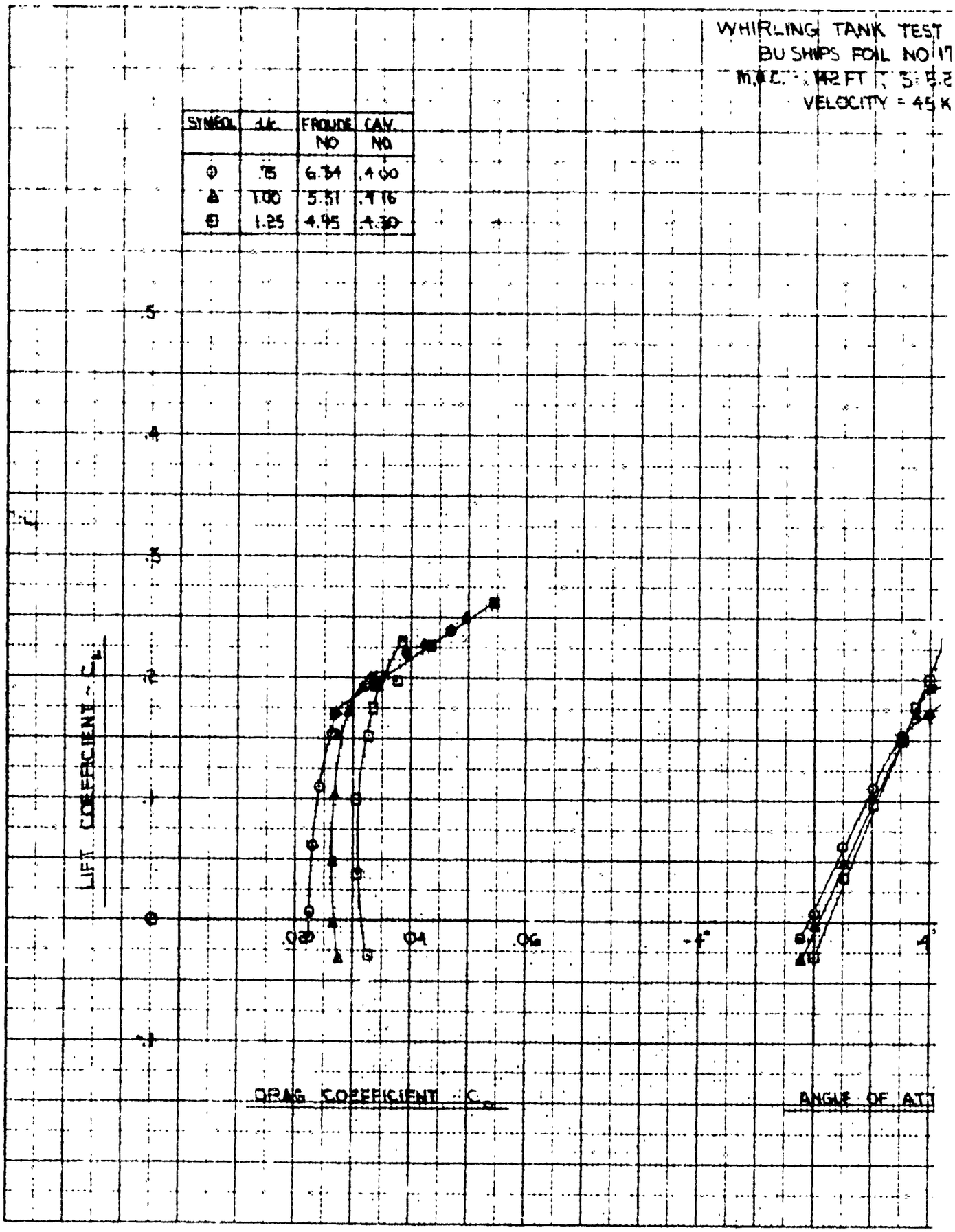


WHIRLING TANK TEST NO 47
BU SHIPS FOIL NO 17
$S = 8.23\ in^2$; MAC = .142 FT
V = 40 KTS

ORMENED POINTS INDICATE
NTED FLOW

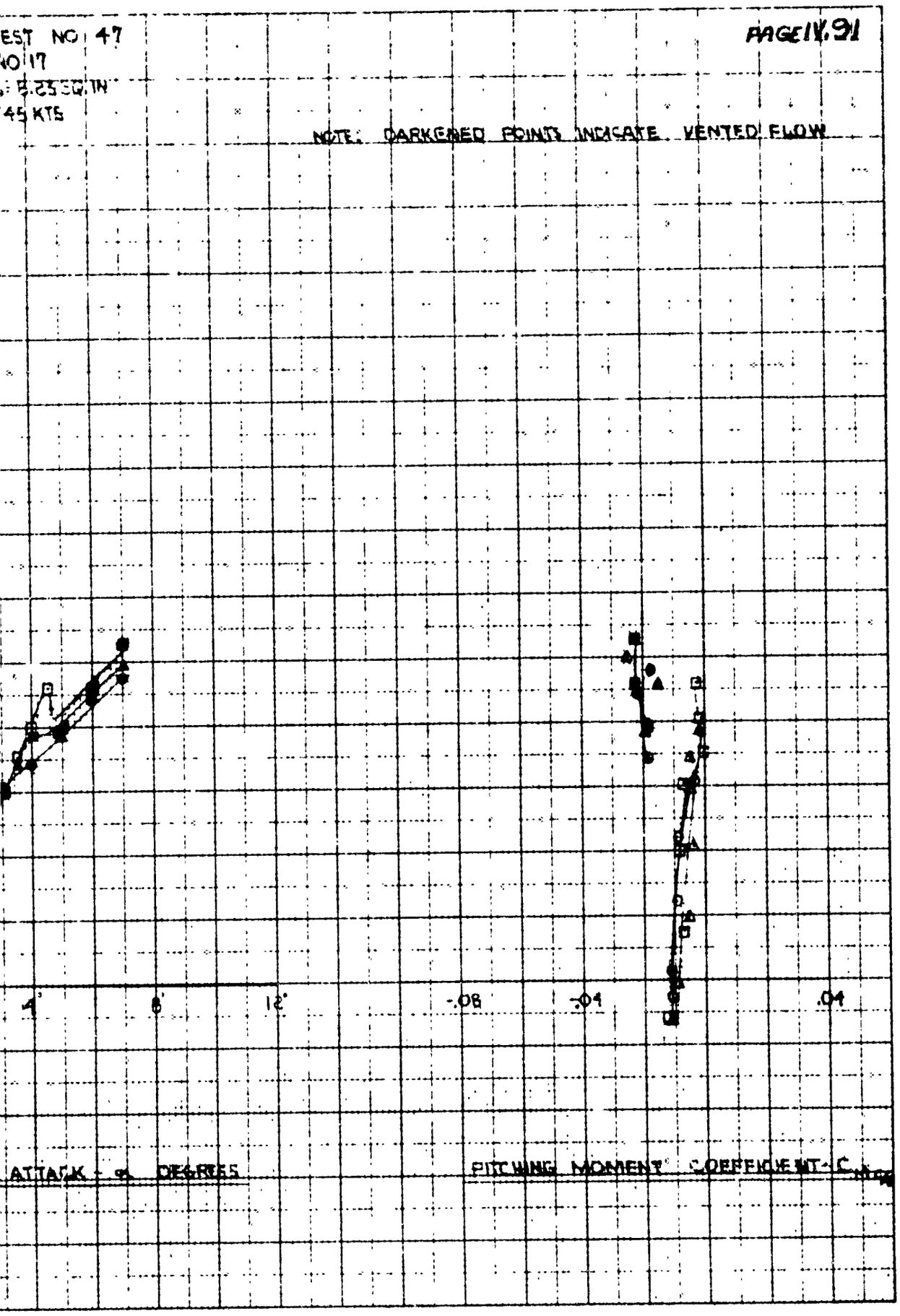


ATTACK ~ α ~ DEGREES PITCHING MOMENT COEFFICIENT ~ $C_{M_{c/4}}$


WHIRLING TANK TEST
BU SHIPS FOIL NO 17
VELOCITY = 45 K
SYMBOL
FROUDE NO
CAV. NO
.75
6.34
.400
1.00
5.51
.316
1.25
4.95
.230
LIFT COEFFICIENT - C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-4°
DRAG COEFFICIENT - C_D
ANGLE OF ATT

EST NO. 47
NO 17
: 8.25 SQ. IN
45 KTS

NOTE: DARKENED POINTS INDICATE VENTED FLOW

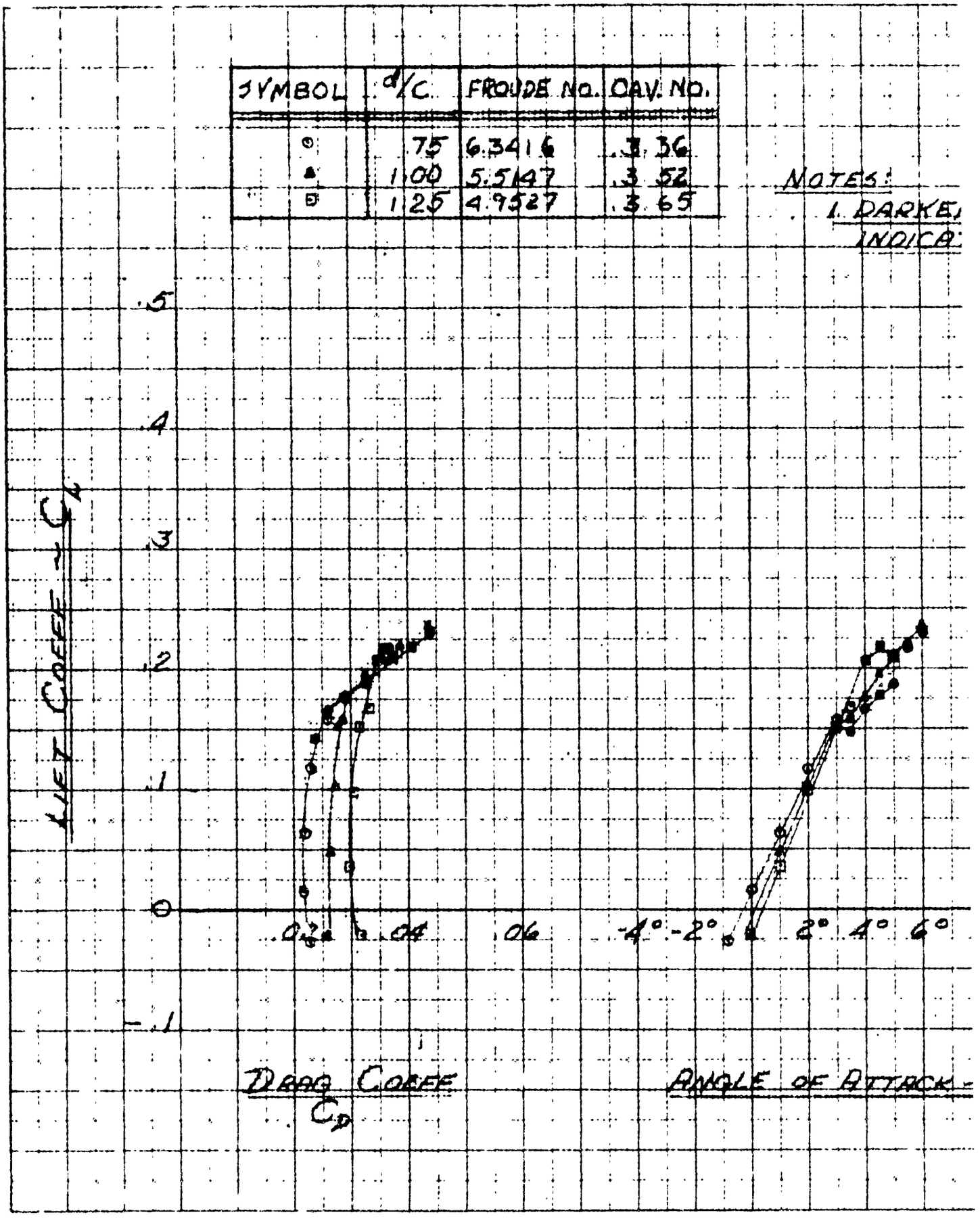


ATTACK - α DEGREES

PITCHING MOMENT COEFFICIENT - $C_{m_{c/4}}$

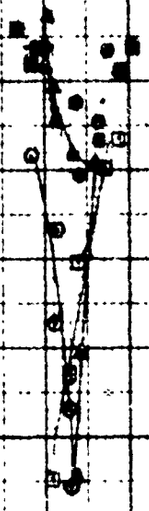
SYMBOL	d/c	FROUDE No.	CAV. NO.
○	.75	6.3416	.336
△	1.00	5.5147	.352
□	1.25	4.9527	.365

NOTES:
1. DARKE
INDICA



W.I.T. No 47 BuShips Foil No. 17
M.A.C. .142 FT. AREA = 8.23 $\square''$
VEL. = 50 KTS.

KENED SYMBOLS
CATE VENTED FLOW.



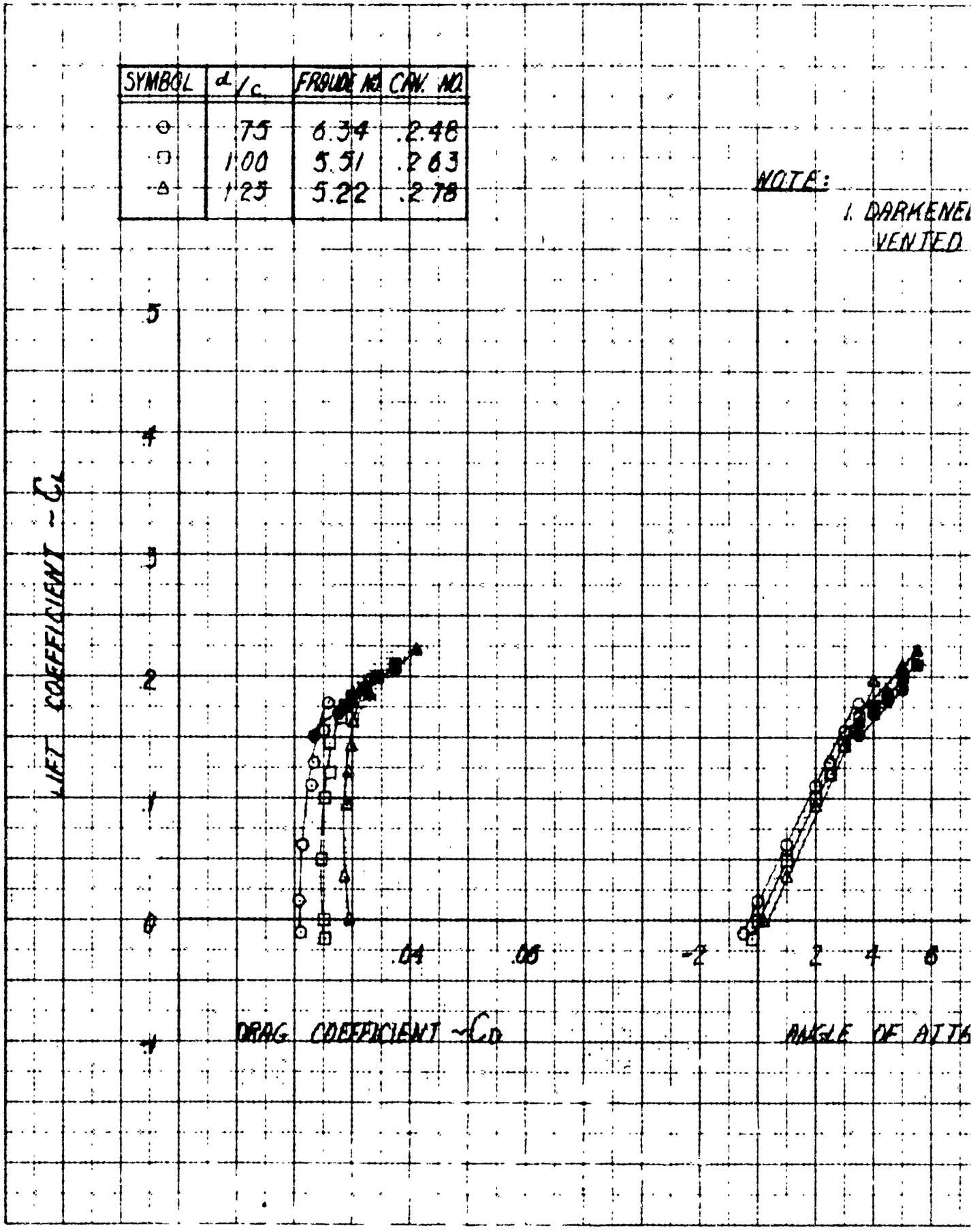
° 8° 10° 12° -.08 -.04 +.04

K - DEGREES PITCHING MOMENT COEFF - $C_{m_{cg}}$

SYMBOL	d/c	FROUDE NO.	CAV. NO.
○	.75	6.34	.248
□	1.00	5.51	.263
△	1.25	5.22	.278

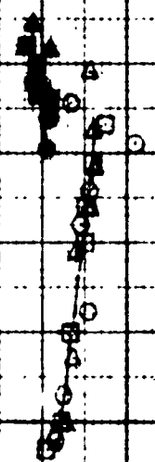
NOTE:

1. DARKENED
VENTED



WHIRLING TANK TEST NO. 47
BU SHIPS EGIL NO. 17
MAC = .142 FT ; S = 8.23 IN²
V = 6.0 K.T.S. PAGE IV-93

ENED POINTS INDICATE
ED FLOW

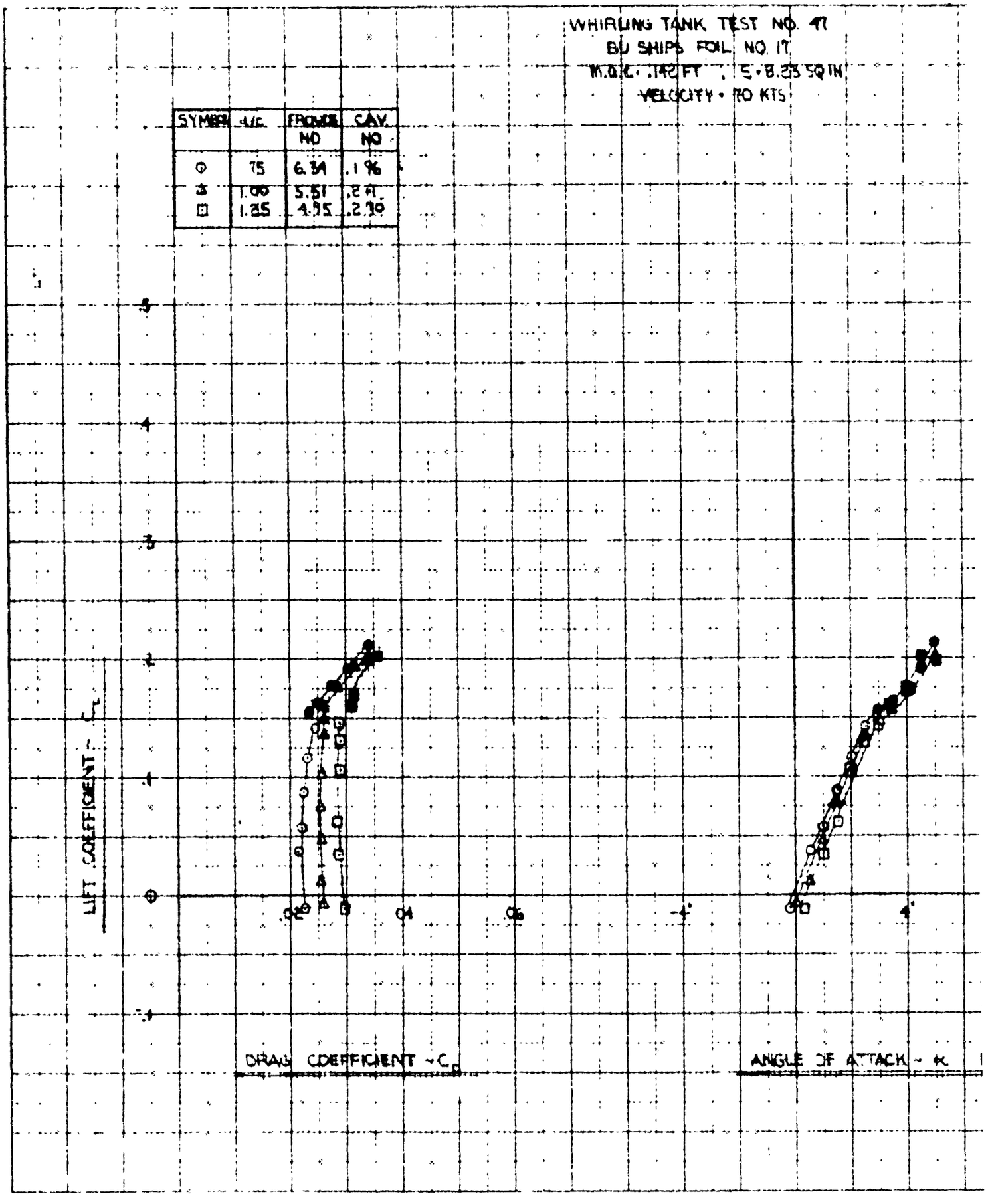


5 8 10 -.08 -.04 .04

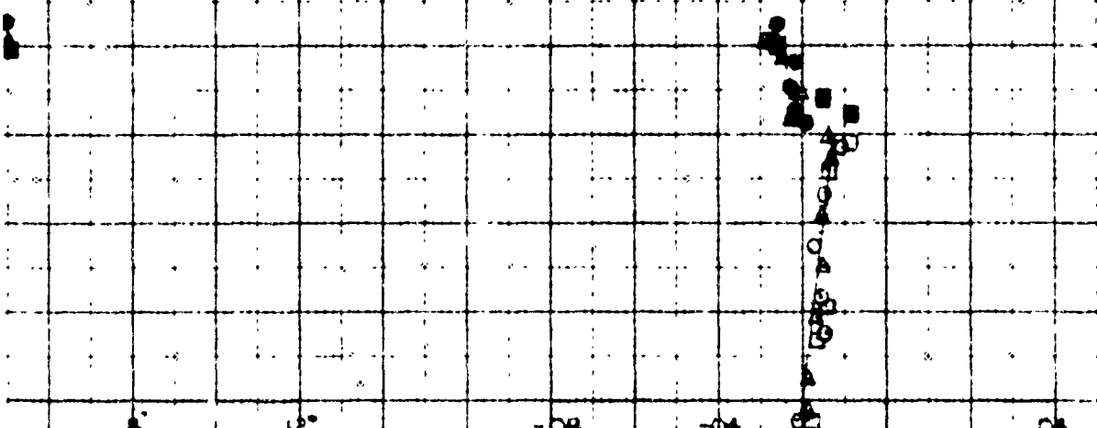
ITACK = α = DEGREES PITCHING MOMENT
COEFFICIENT = $C_{M_{3/4}}$

WHIRLING TANK TEST NO. 47
BU SHIPS FOIL NO. 17
M.O.C. .142 FT , S. 8.25 SQ IN
VELOCITY = 70 KTS

SYMBOL	A/C	FROUDE NO	CAV NO
○	.75	6.34	.196
△	1.00	5.51	.271
□	1.25	4.95	.346



NOTE: DARKENED POINTS INDICATE VENTED FLOW

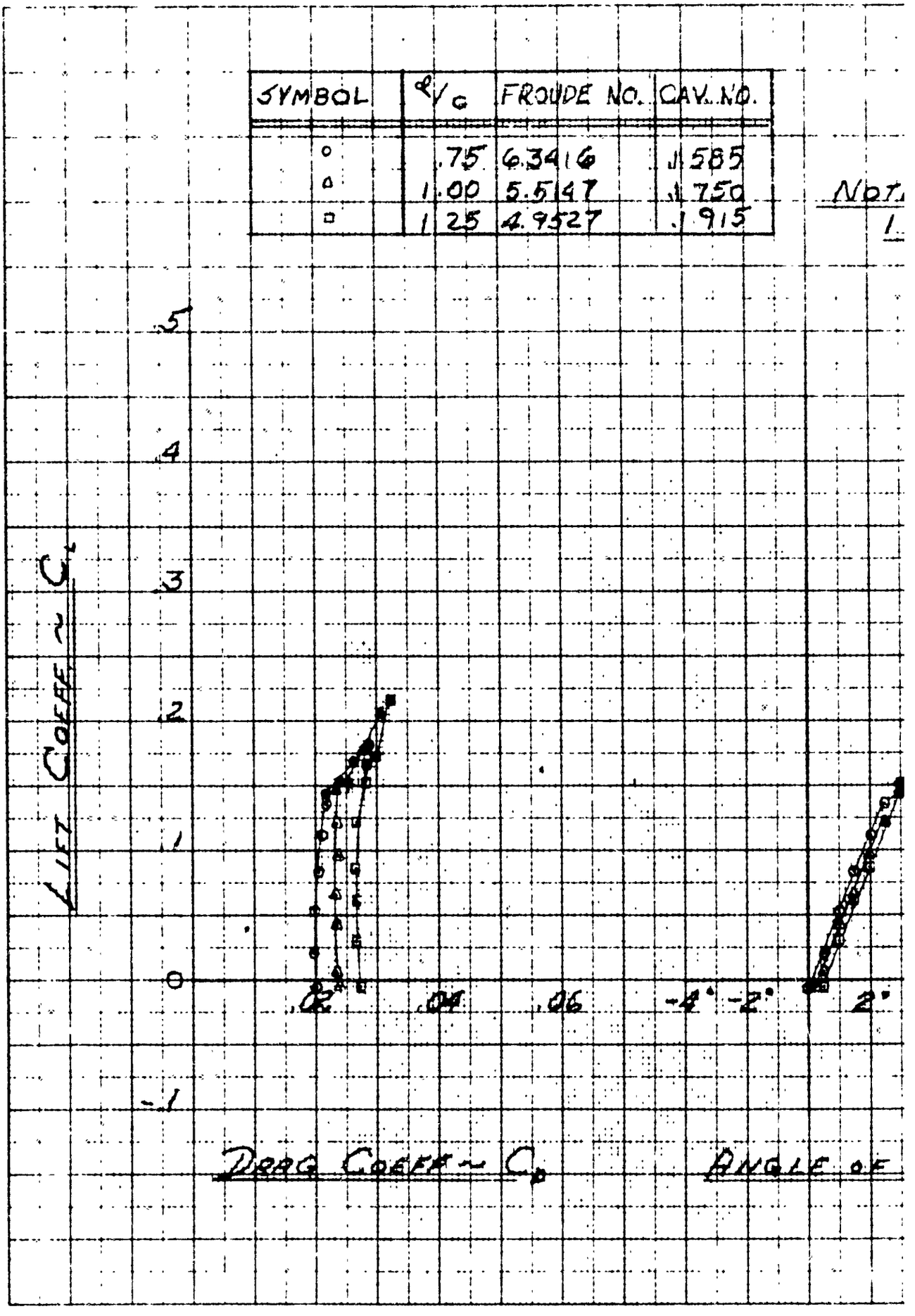


α DEGREES

PITCHING MOMENT COEFFICIENT - C_m

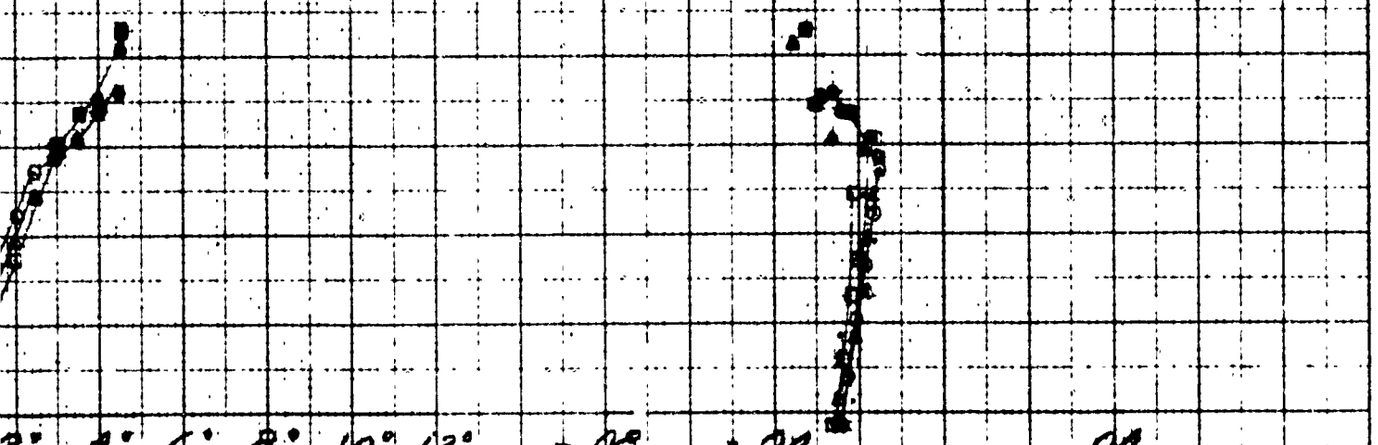
SYMBOL	ℓ/c	FROUDE NO.	CAV. NO.
○	.75	6.3416	.1585
△	1.00	5.5147	.1750
□	1.25	4.9527	.1915

NOTE
1.



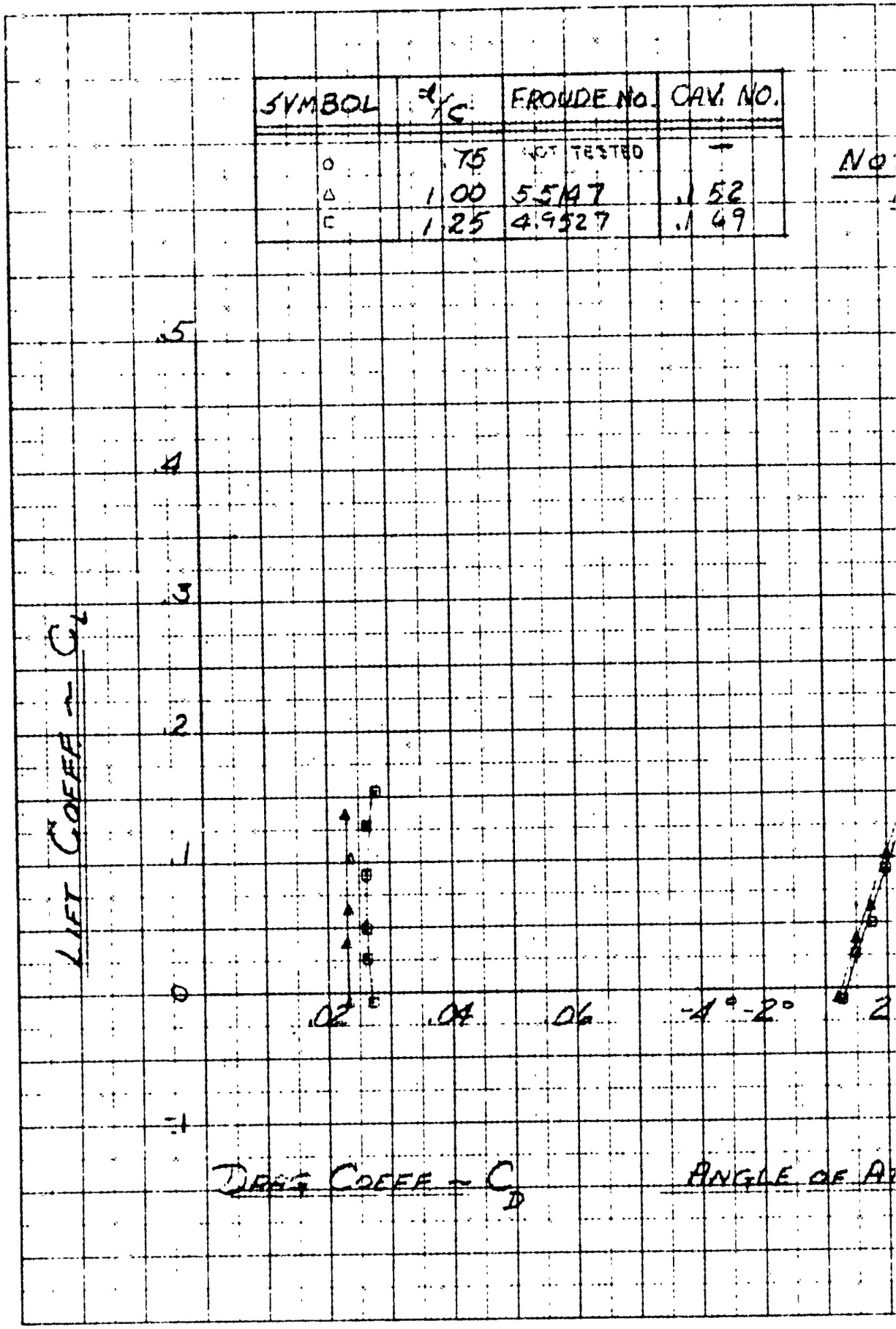
W.T.T. No. 47 BUSHIPS FOIL No. 17
M.A.C. .142 FT. AREA = 8.23 □"
VEL = 90 KTS

OTES:
1. DARKENED SYMBOLS INDICATE VENTED FLOW



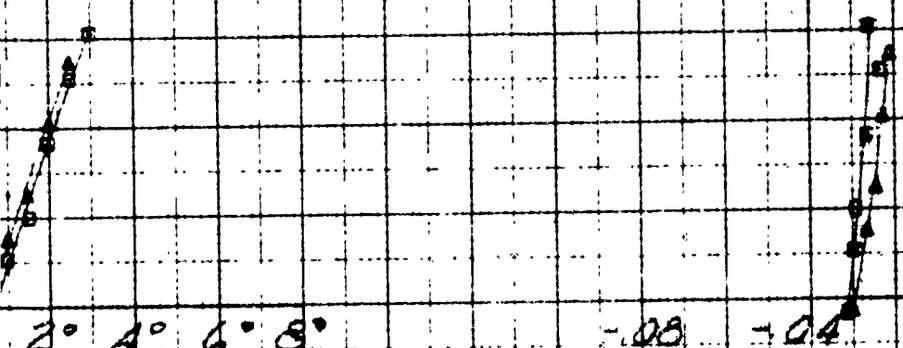
E ATTACK — DEGREES
PITCHING MOMENT COEFF. — $C_{M_{c/4}}$

SYMBOL	ℓ/c	FROUDE No.	CAV. NO.
○	.75	NOT TESTED	—
△	1.00	5.5497	.152
□	1.25	4.9527	.149



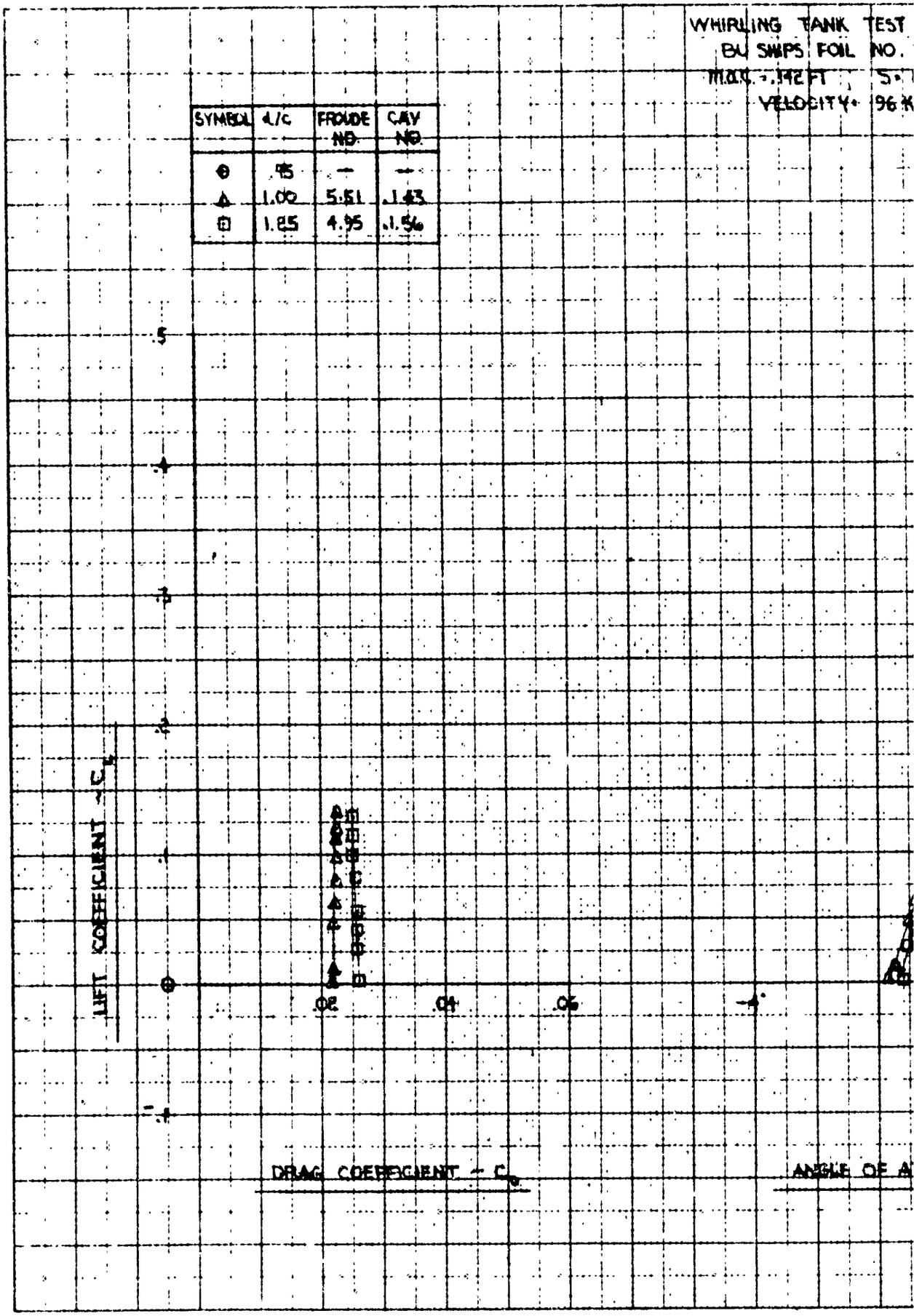
W.T.T. NO. 47 BUSHIPS FOIL NO. 17
MAC. = .182 FT. AREA = 8.230"
VEL = 90 KTS

NOTES:
1. DARKENED SYMBOLS INDICATE VENTED FLOW



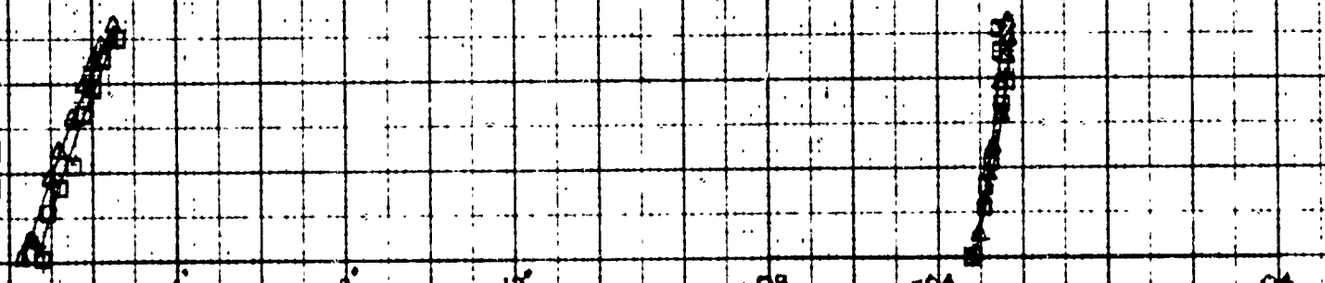
ATTACK - DEGREES

PITCHING MOMENT COEFF - $C_{M_{c/4}}$


WHIRLING TANK TEST
BU SHIPS FOIL NO.
M.A.C. = .142 FT
VELOCITY = 96 K
SYMBOL
A/C
FROUDE NO.
CAV NO.
.05
1.00
5.51
.143
1.85
4.95
.156
LIFT COEFFICIENT - C_L
DRAG COEFFICIENT - C_D
ANGLE OF A
.02
.04
.06
-4°

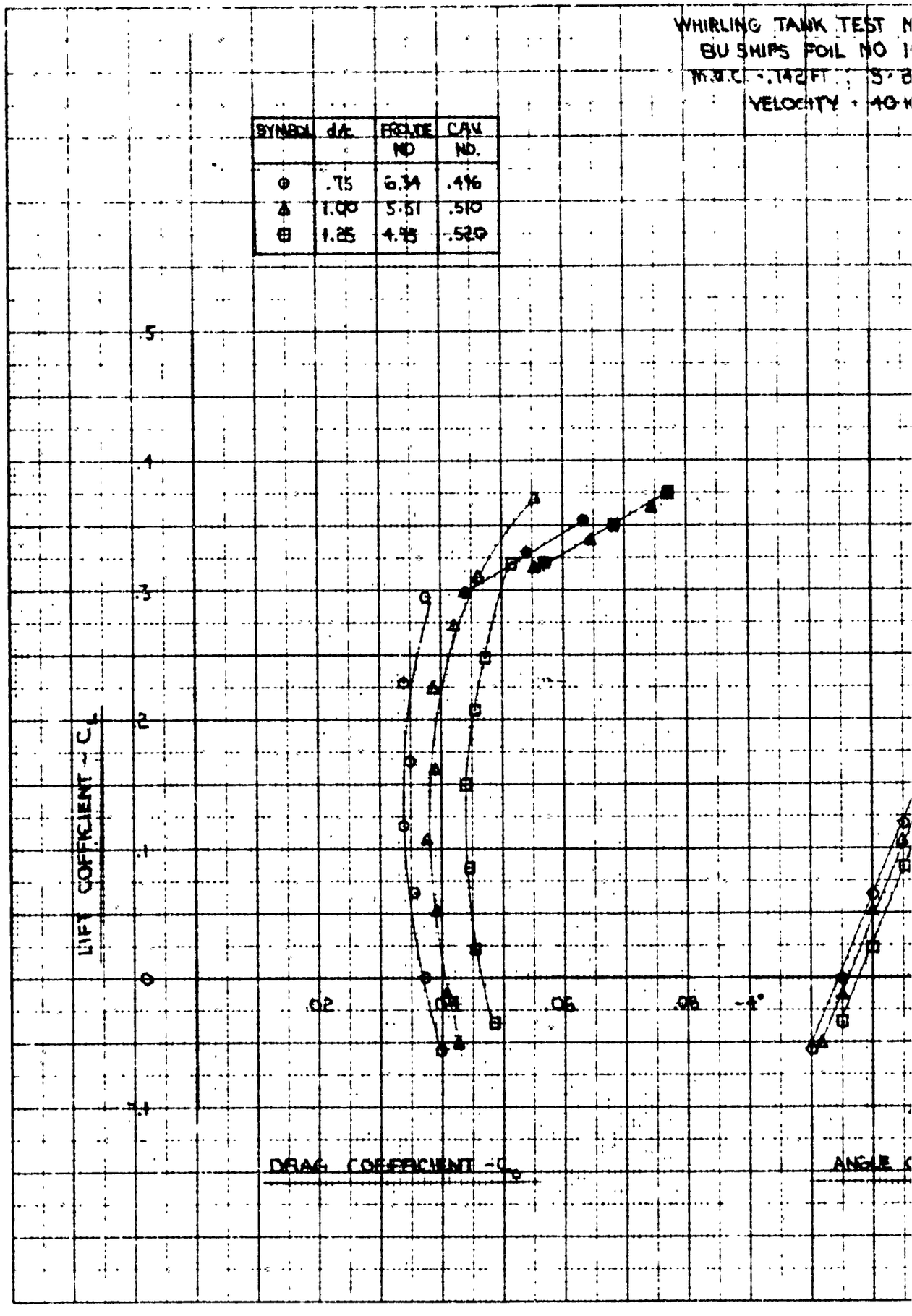
TEST NO 47
NO. 17
S= 8.25 SQIN.
96 KTS

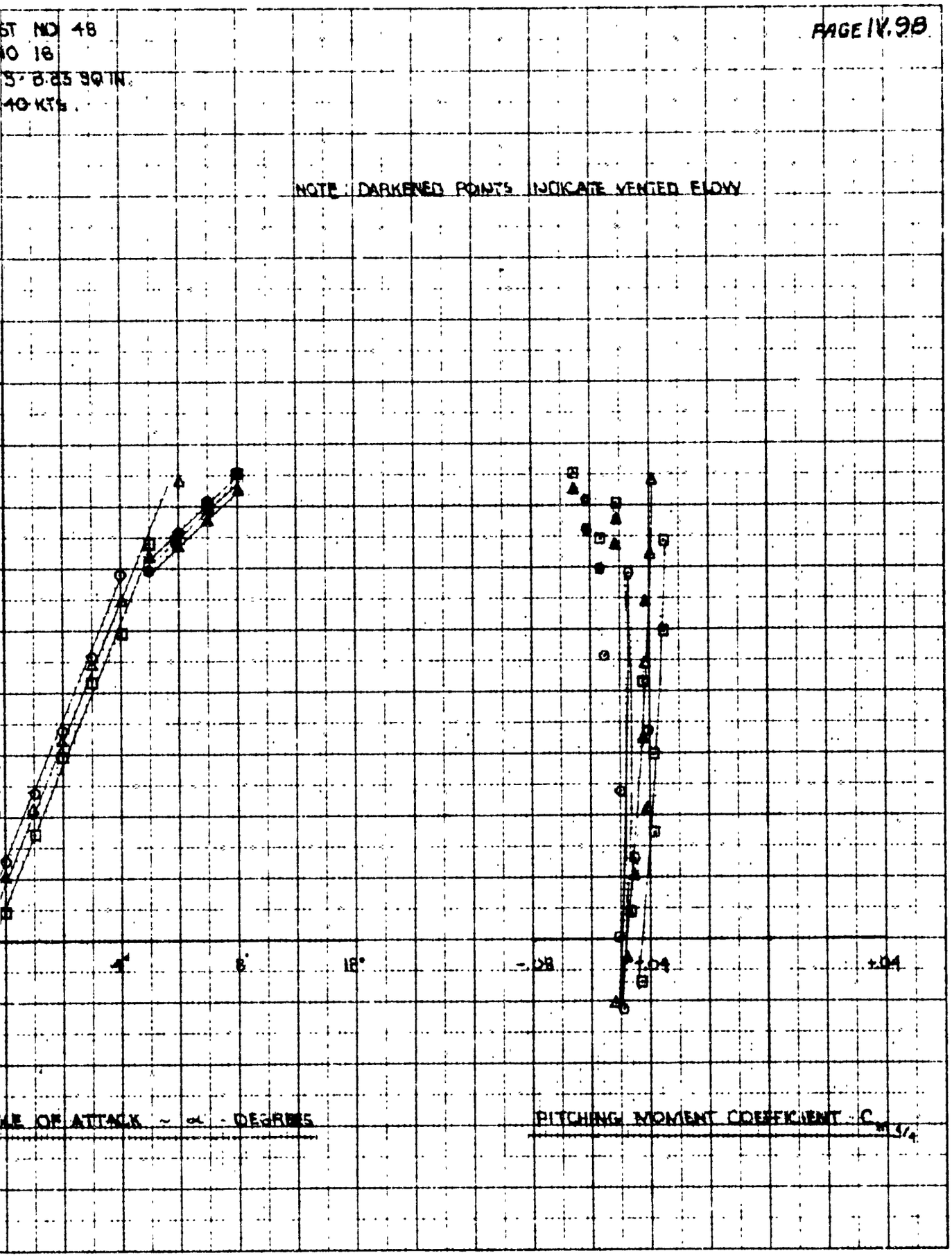
NOTE t/c = .15 WAS NOT TESTED DUE TO EXTREME WATER ROUGHNESS.



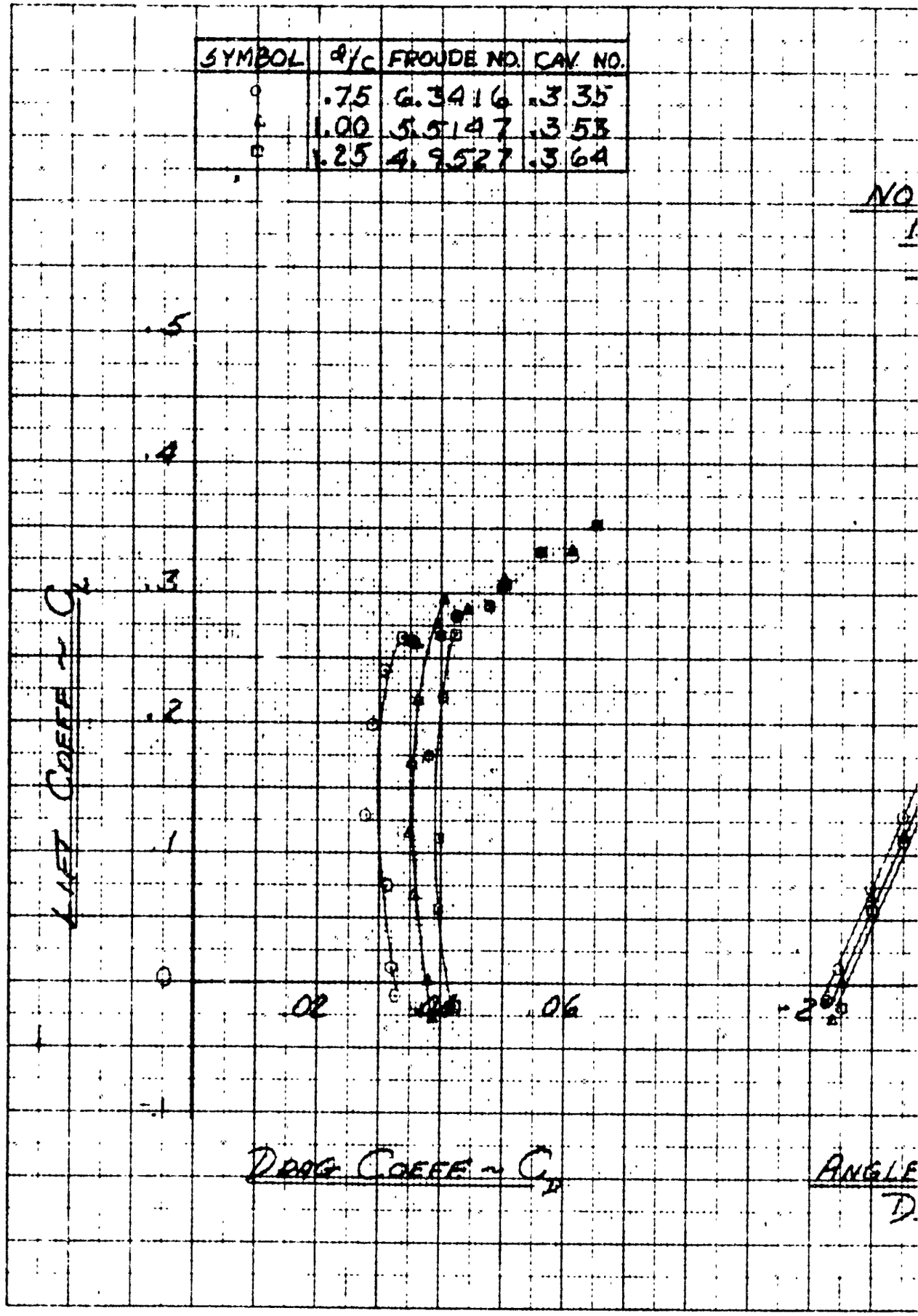
OF ATTACK - α - DEGREES

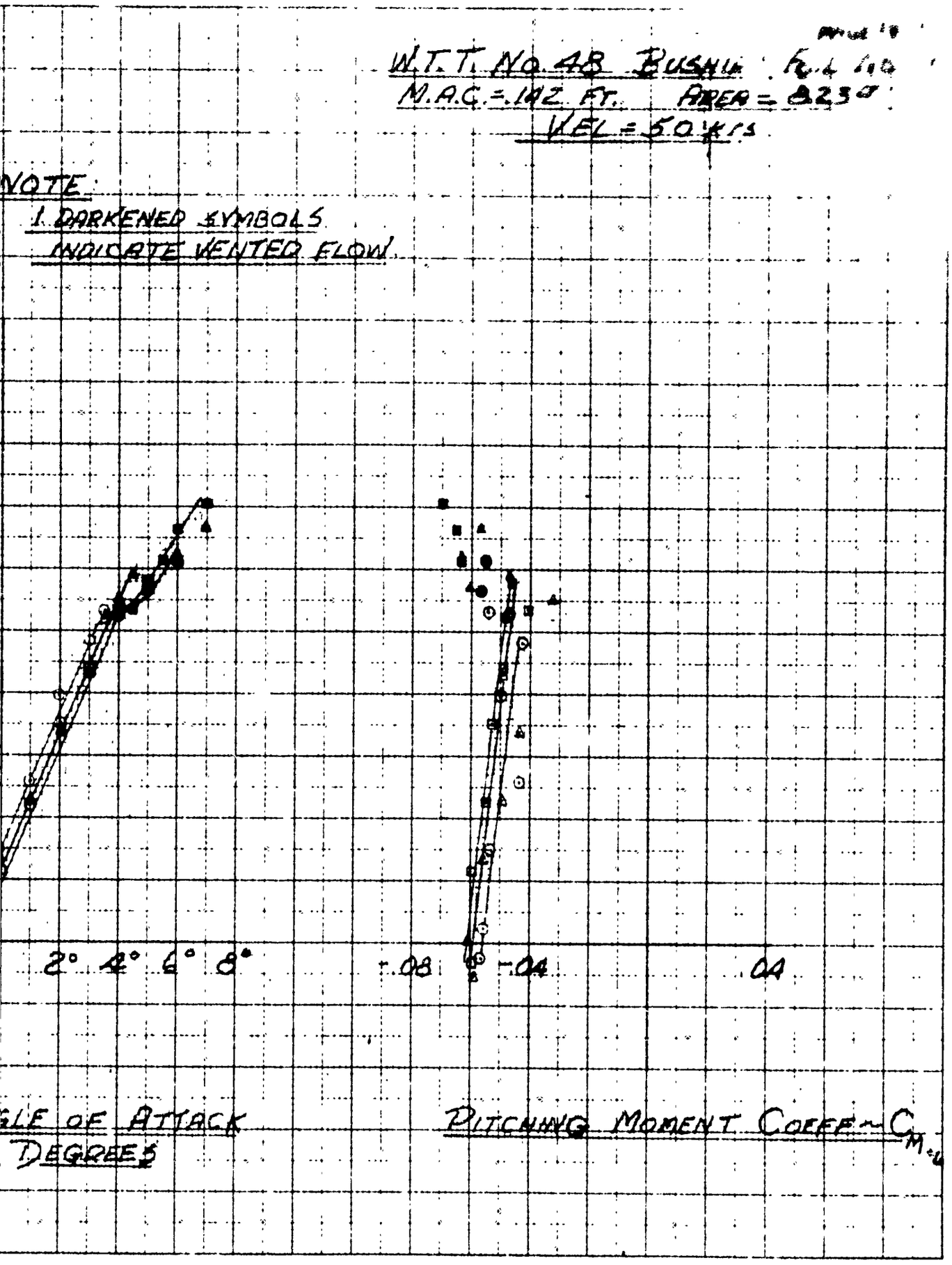
PITCHING MOMENT COEFFICIENT - $C_{m_{c/4}}$


WHIRLING TANK TEST N
BU SHIPS FOIL NO 1
M.A.C. = .142 FT ; S = 8
VELOCITY = 40 K
SYMBOL | d/c | FROUDE NO | CAV NO.
⊙ | .75 | 6.34 | .496
△ | 1.00 | 5.51 | .510
⊡ | 1.25 | 4.95 | .520
.5
.4
.3
.2
.1
0
-.1
LIFT COEFFICIENT ~ C_L
.02
.04
.06
.08
-4°
DRAG COEFFICIENT ~ C_D
ANGLE


ST NO 48
10 18
5 - 8.85 SQ IN.
40 KTS.
PAGE IV.98
NOTE: DARKENED POINTS INDICATE VENTED FLOW
4°
8°
18°
-.08
+.04
+.04
LE OF ATTACK ~ α - DEGREES
PITCHING MOMENT COEFFICIENT $C_{m_{1/4}}$

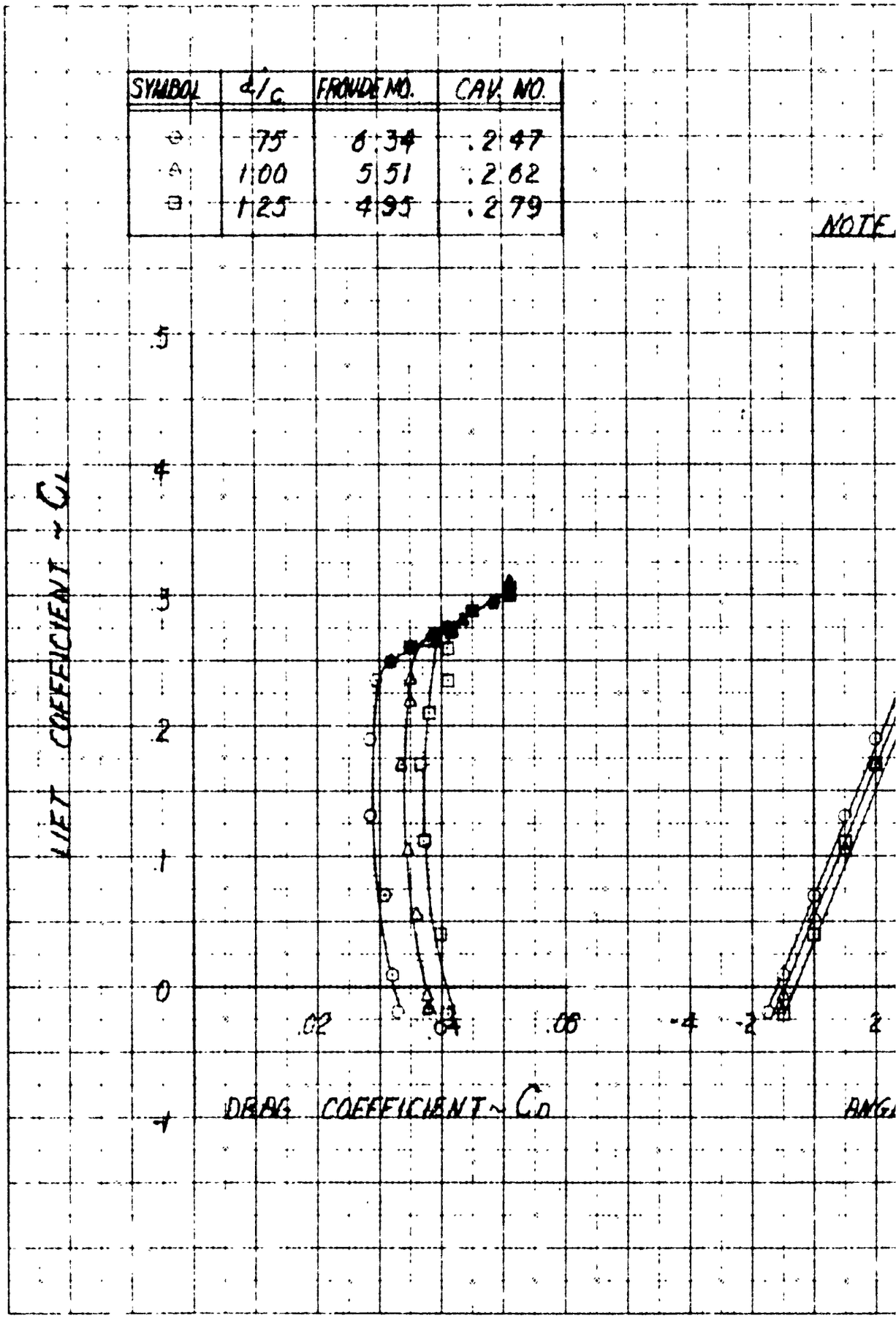
SYMBOL	q/c	FROUDE NO.	CAV. NO.
○	.75	6.3416	.335
◐	1.00	5.5147	.353
●	1.25	4.9527	.364




W.T.T. No. 48 BUSHIP
M.A.C. = .142 FT. AREA = 8.23
VEL = 50 KTS
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.
2° 4° 6° 8°
-.08
-.04
.04
GLE OF ATTACK
DEGREES
PITCHING MOMENT COEFF ~ $C_{M_{.4}}$

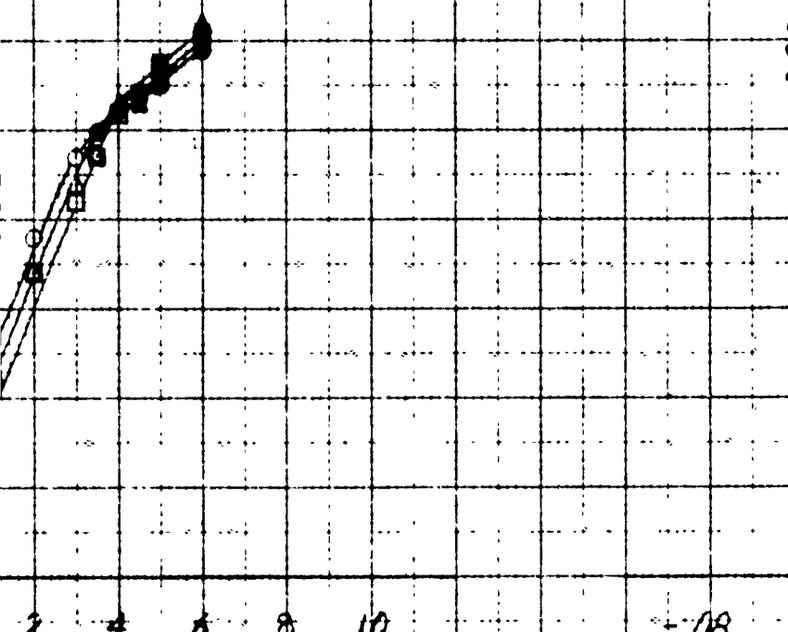
SYMBOL	d/c	FROUDE NO.	CAV. NO.
⊖	.75	6.34	.247
△	1.00	5.51	.262
⊟	1.25	4.95	.279

NOTE



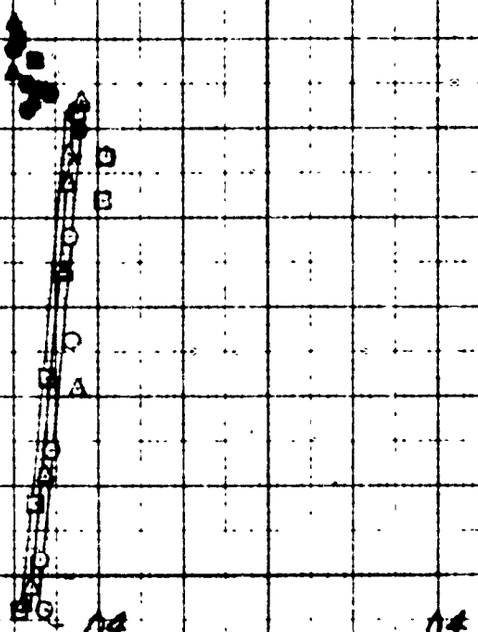
WHIRLING TANK TEST NO. 48
BU. SHIPS FOIL NO. 18
S = 8.23 IN² MAC = .142 FT.
V = 50 KTS.

TE:
DARKENED POINTS INDICATE
VENTED FLOW.



2 4 6 8 10

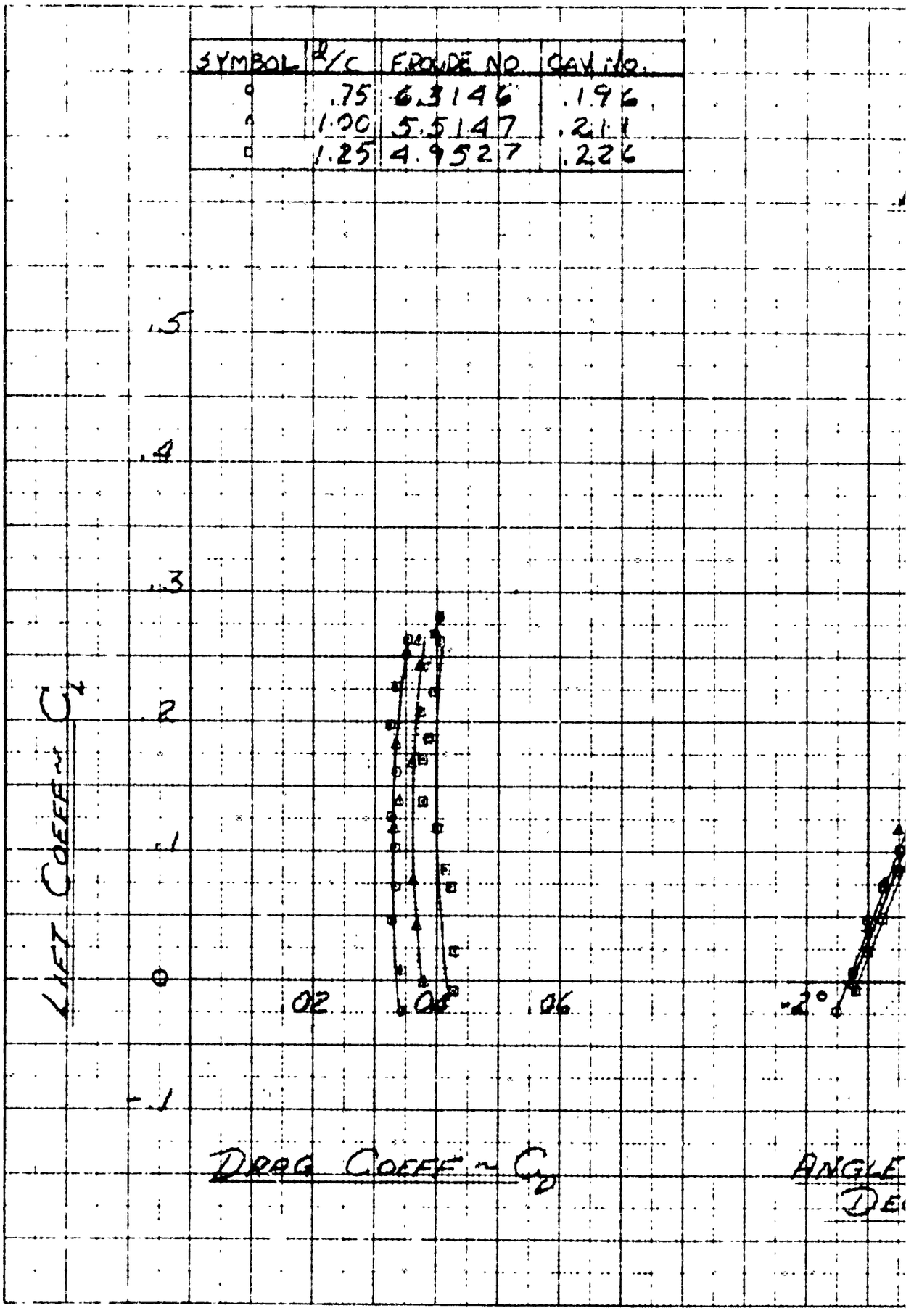
ANGLE OF ATTACK ~ α - DEGREES



-.08 -.04 .04

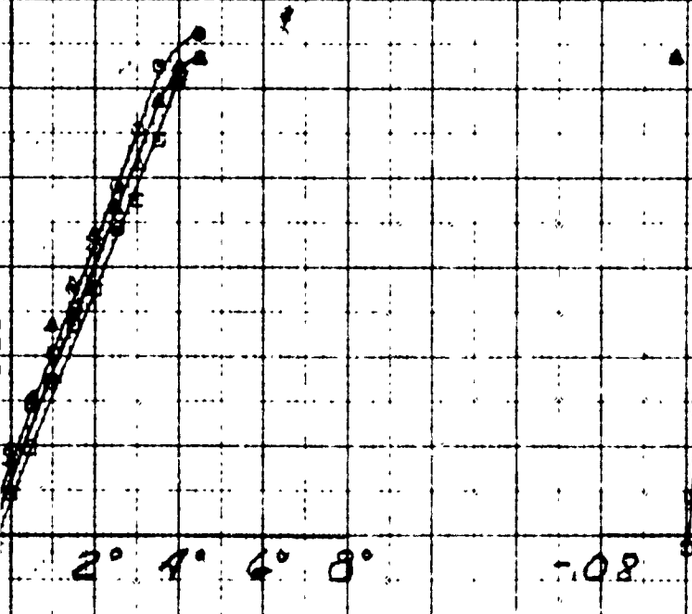
PITCHING MOMENT
COEFFICIENT ~ $C_{M_{c/4}}$

SYMBOL	b/c	FROUDE NO	CAVITATION NO.
○	.75	6.3146	.196
△	1.00	5.5147	.211
□	1.25	4.9527	.226



W.T.T. No 48 BuShips Foil No. 18
M.A.C. = .142 FT AREA = 8.230"
VEL = 70 KTS

NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.

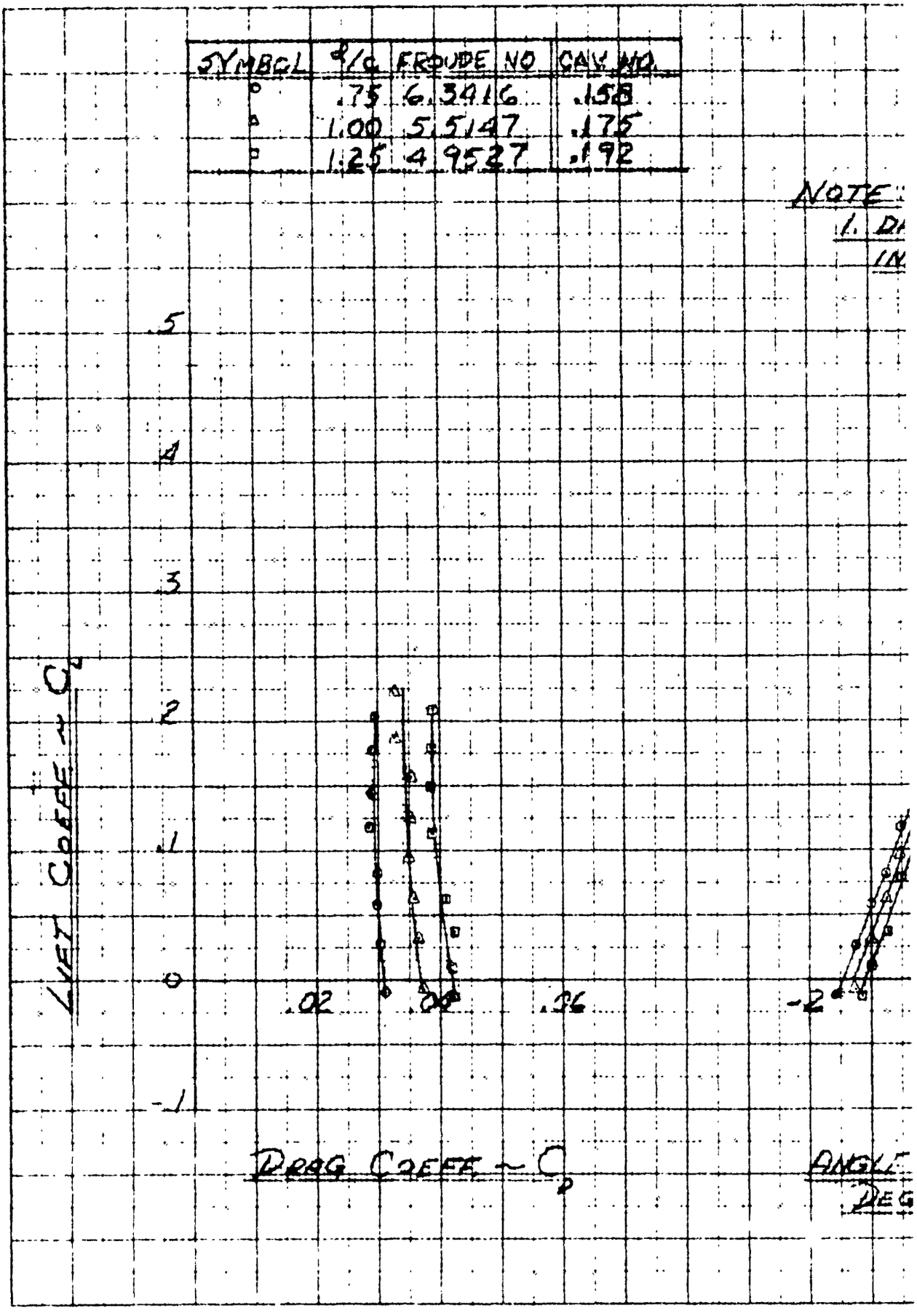


LE OF ATTACK
DEGREES

PITCHING MOMENT
COEFF. ~ $C_{M_{C/4}}$

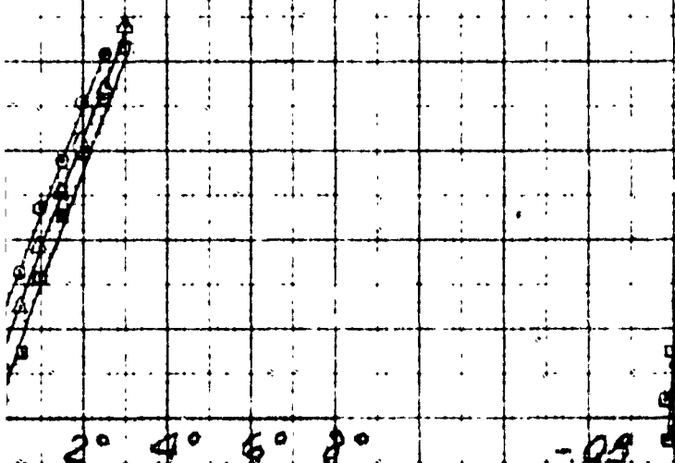
SYMBOL	t/c	FROUDE NO	CAV NO.
○	.75	6.3416	.158
△	1.00	5.5147	.175
□	1.25	4.9527	.192

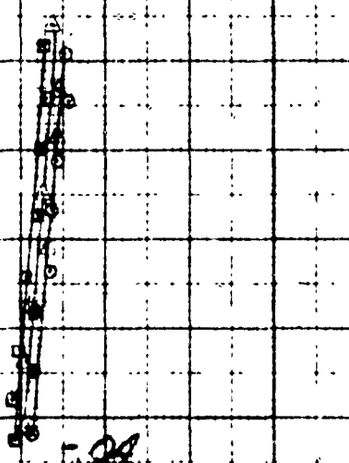
NOTE:
1. DA
IN



W. T. T. No. 48 Buships Foil No. 18
M.A.C. = 1.42 FT AREA = 8.230"
VEL. = 80 KTS

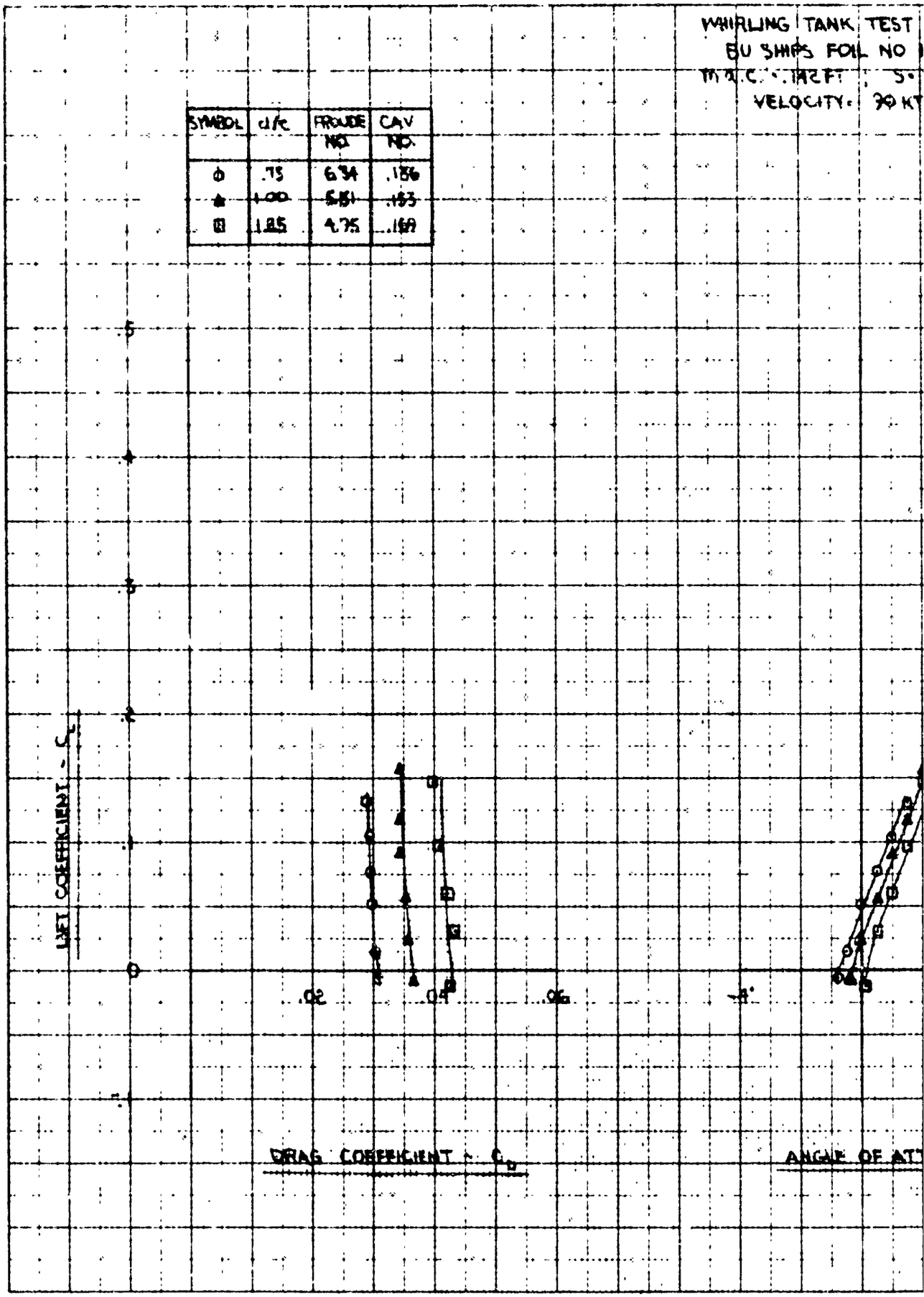
E:
DARKENED SYMBOLS
INDICATE VENTED FLOW



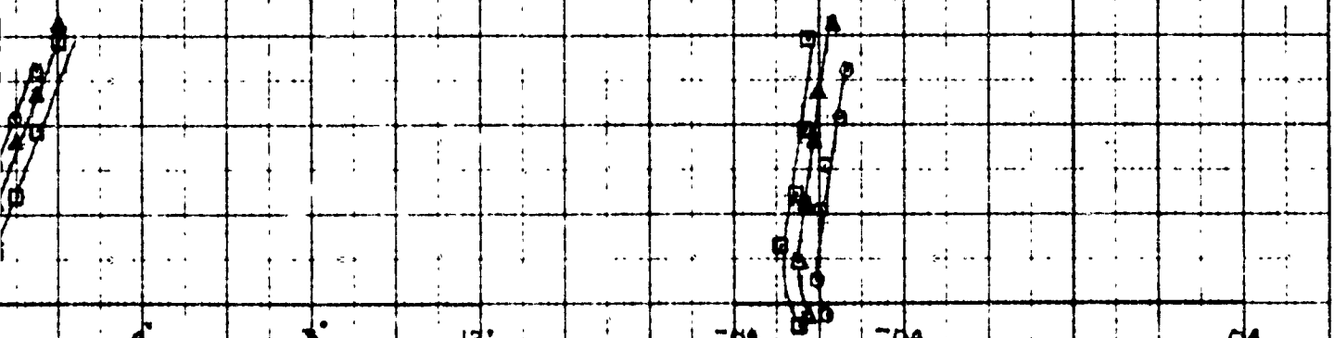


T OF ATTACK
EGREES

PITCHING MOMENT
COEFF. ~ $C_{M_{c/4}}$


WHIRLING TANK TEST
BU SHIPS FOIL NO
VELOCITY: 30 KT
SYMBOL | d/c | FROUDE NO. | CAV NO.
.75 | 6.34 | .186
1.00 | 5.81 | .153
1.25 | 4.75 | .169
LIFT COEFFICIENT - C_L
.5
.4
.3
.2
.1
0
-.1
.02
.04
.06
-4°
DRAG COEFFICIENT - C_D
ANGLE OF ATT

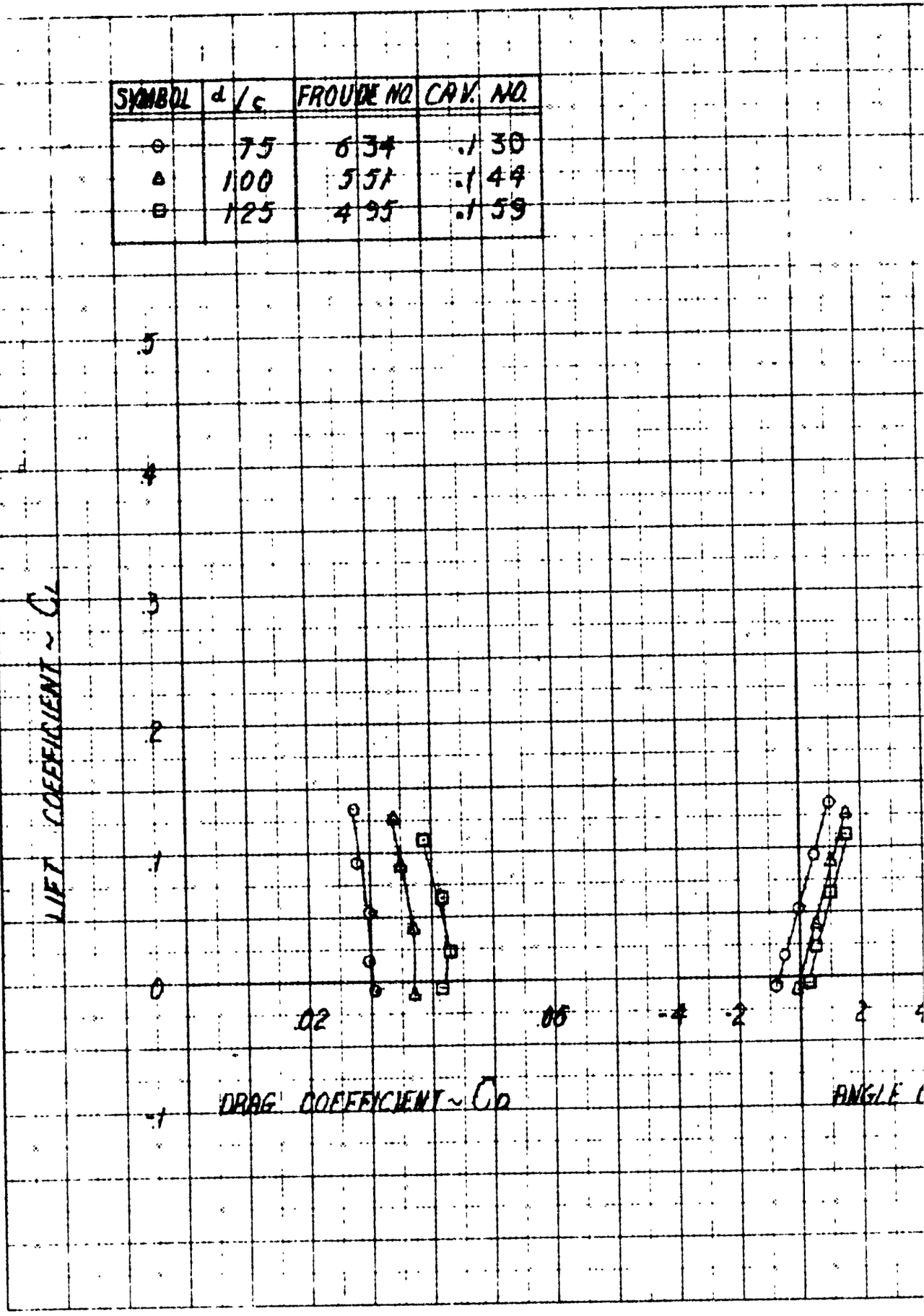
EST NO 48
NO 18
S. 8.25 SQ IN
KTS



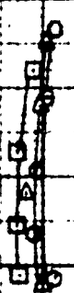
ATTACK - α - DEGREES

PITCHING MOMENT COEFFICIENT - C_m $\frac{}{q}$

SYMBOL	d/c	FROUDE NO	CAV. NO
○	.75	6.34	.130
△	1.00	5.51	.144
□	1.25	4.95	.159



WHIRLING TANK TEST NO. 48.
BU SHIPS FOIL NO 18
S = 8.23 IN.² ; MAC = 1.42 IN.
V = 9.5 KTS.

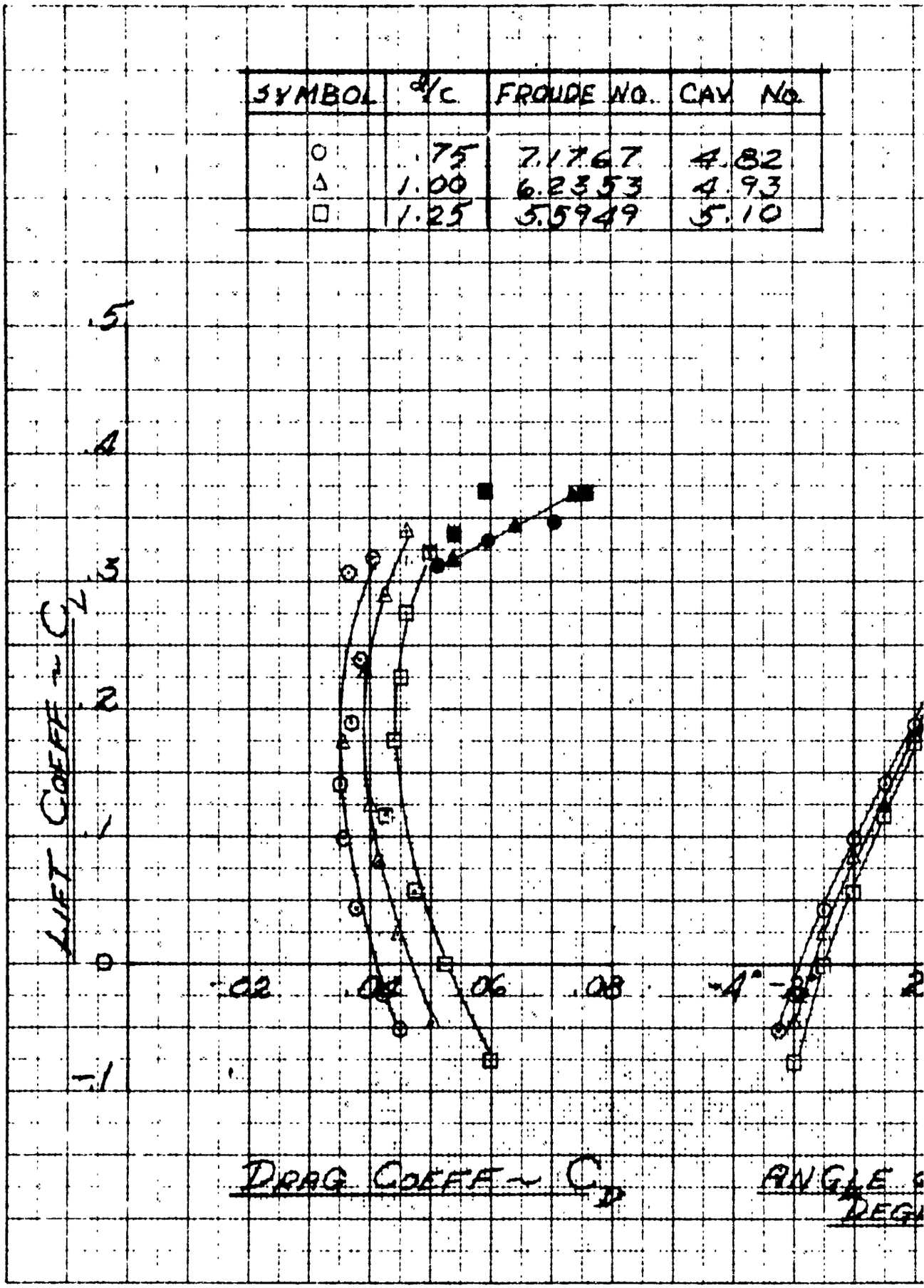


4 6 8 10 -.08 -.04 .04

LE OF ATTACK ~ α ~ DEGREES

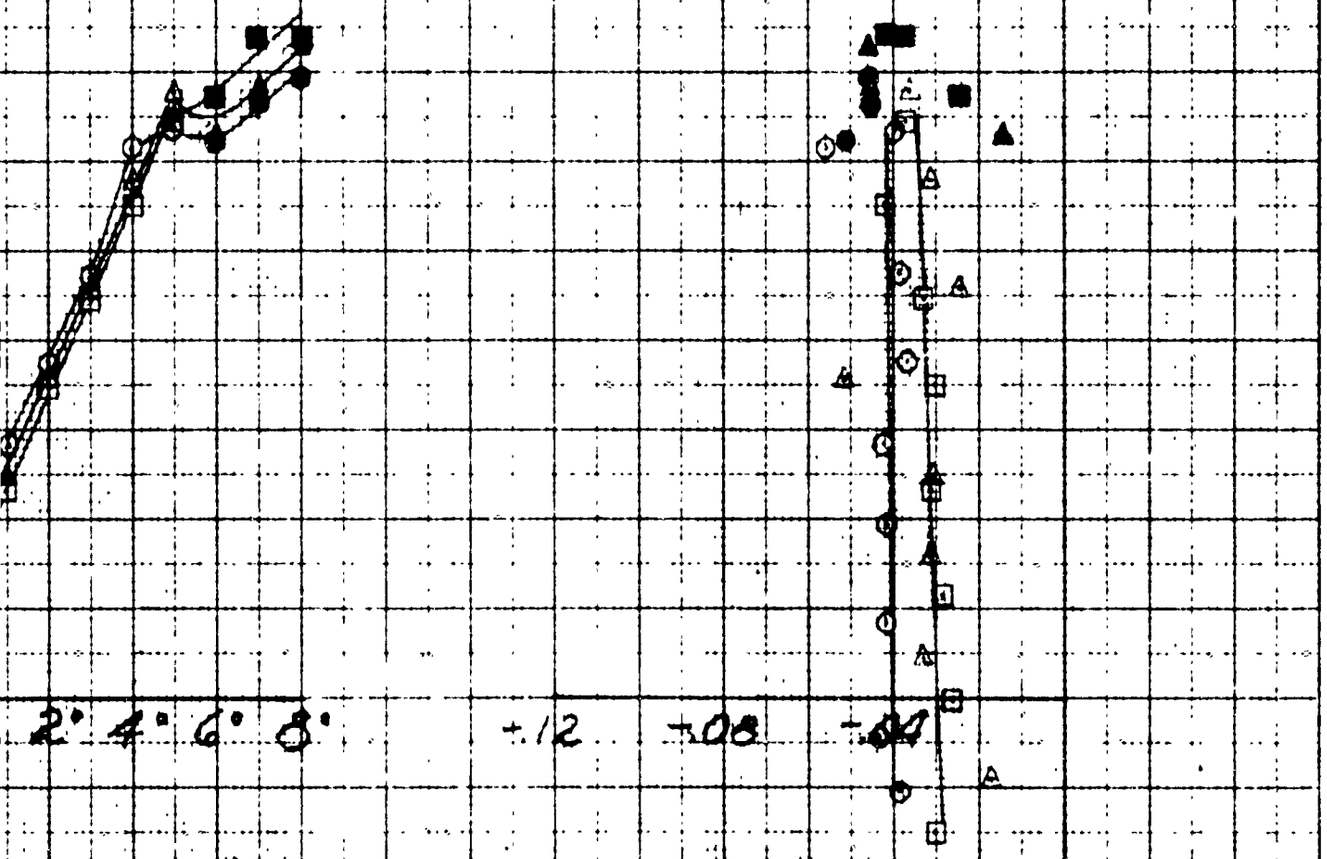
PITCHING MOMENT COEFFICIENT ~ $C_{m_{c/4}}$

SYMBOL	d/c	FROUDE NO.	CAV. No.
○	.75	7.1767	4.82
△	1.00	6.2353	4.93
□	1.25	5.5949	5.10



M.I.T. No. 49 Buships Foil No. 19
M.A.C. = .11 FT. AREA = 8.94 $\square$"
VEL = 40 KTS

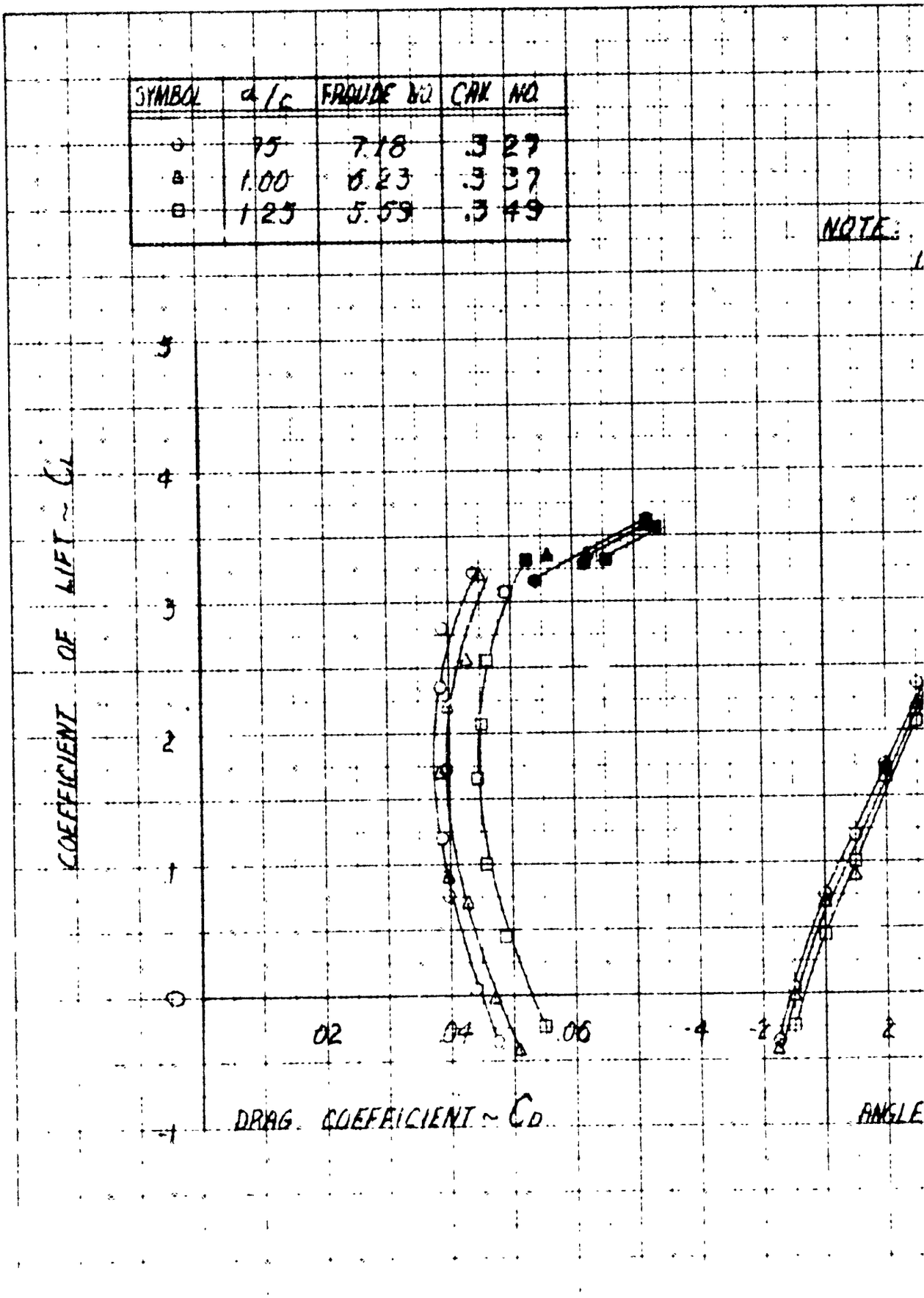
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



2° 4° 6° 8° +.12 +.08 +.04

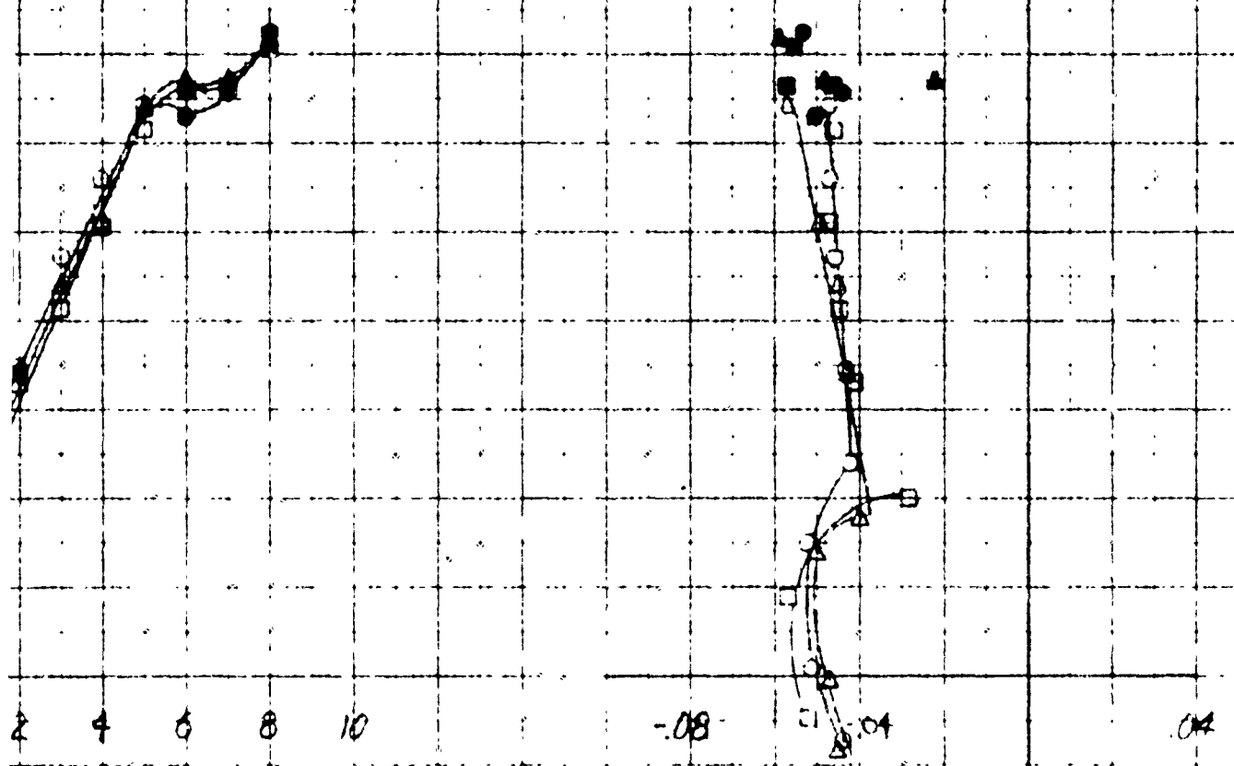
T OF ATTACK
EGREES

PITCHING MOMENT COEFF
$C_{M_{C/4}}$


SYMBOL
d/c
FROUDE NO
CAV NO
○ .75 7.18 .327
△ 1.00 6.23 .337
□ 1.25 5.59 .349
NOTE:
COEFFICIENT OF LIFT ~ C_L
5
4
3
2
1
0
-1
02
04
06
-4
-2
2
DRAG COEFFICIENT ~ C_D
ANGLE

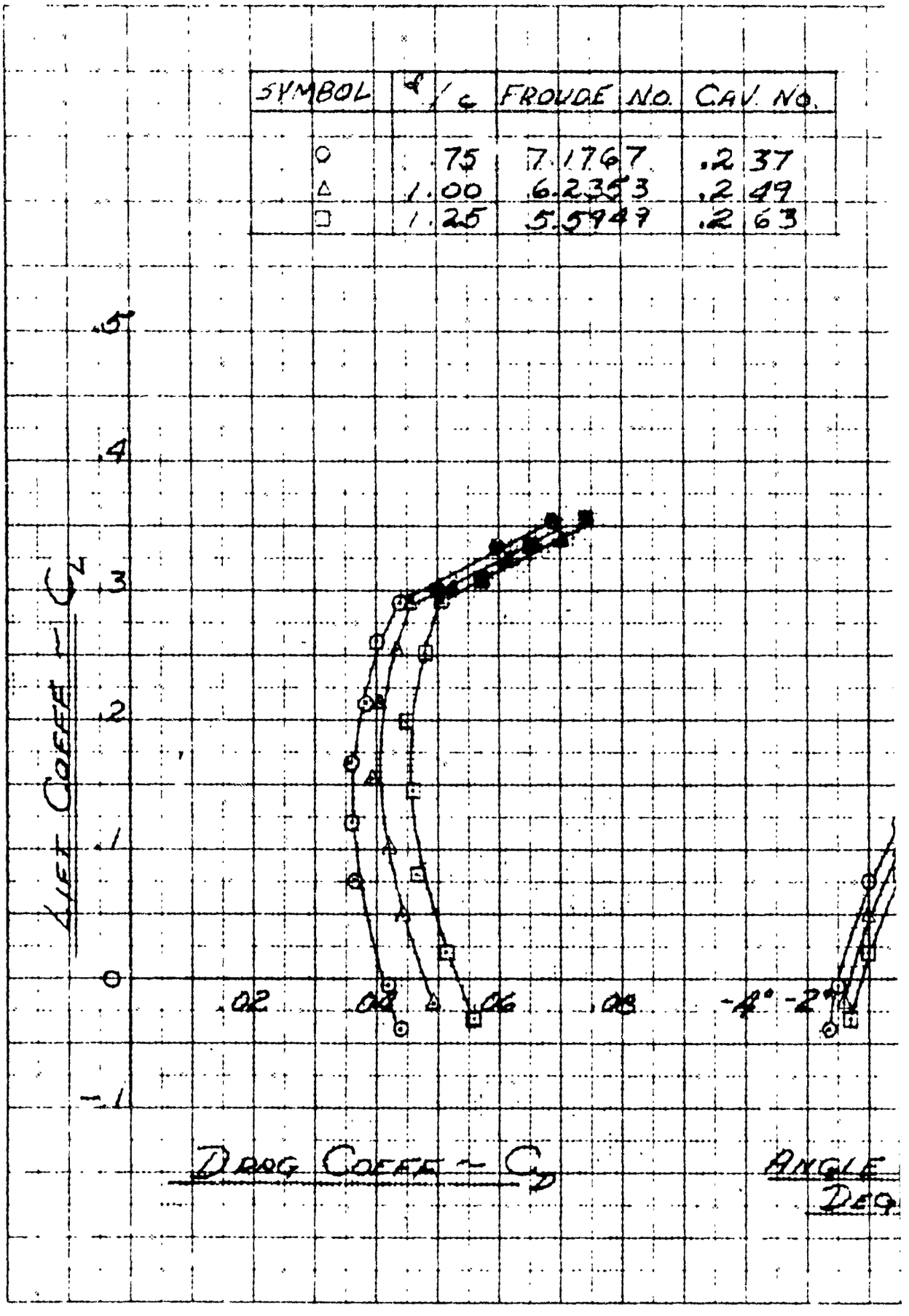
WHIRLING TANK TEST NO 49
BU. SHIPS FOIL NO. 19
$S = 4.94\ IN^2$, MAC = 1.10 FT
V = 56 KTS

1. DARKENED SYMBOLS INDICATE VENTED FLOW.



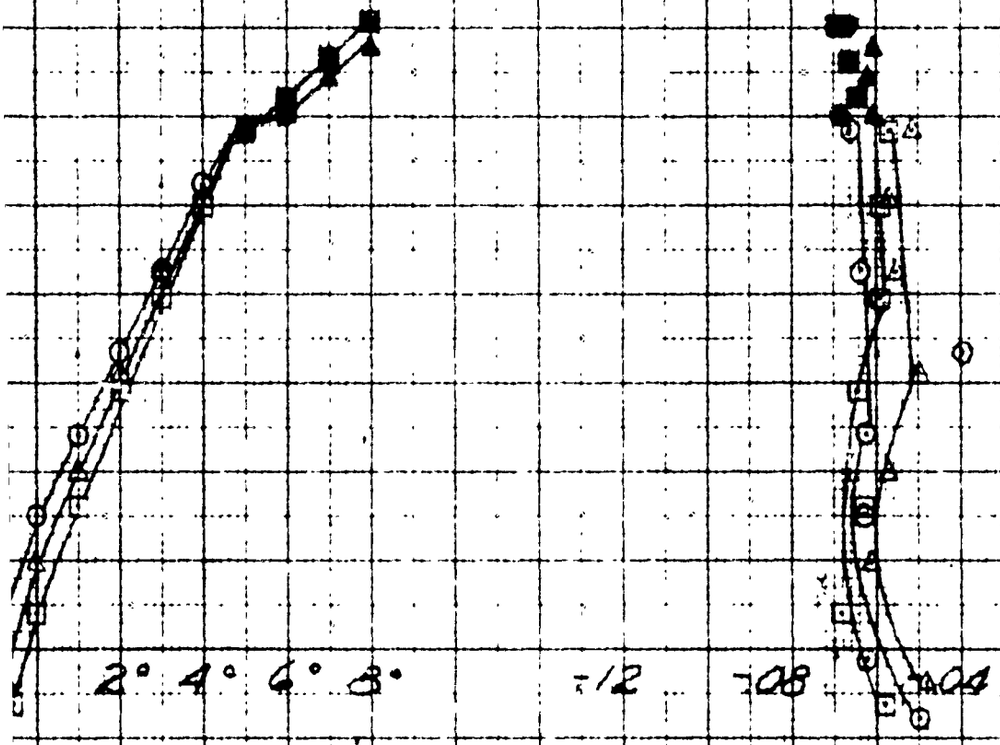
GLE OF ATTACK - α - DEGREES.

PITCHING MOMENT COEFFICIENT - $C_{M_{c/4}}$


SYMBOL
ℓ/c
FROUDE NO.
CAV. NO.
○ .75 7.1767 .237
△ 1.00 6.2353 .249
□ 1.25 5.5949 .263
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF = C_L
.02
.04
.06
.08
-4°
-2°
DRAG COEFF = C_D
ANGLE
DEG

W.T.T. No. 49 Buships Fcl No. 19
MAC = .11 FT. AREA = 4.94 ft²
VEL = 60 KTS

NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW

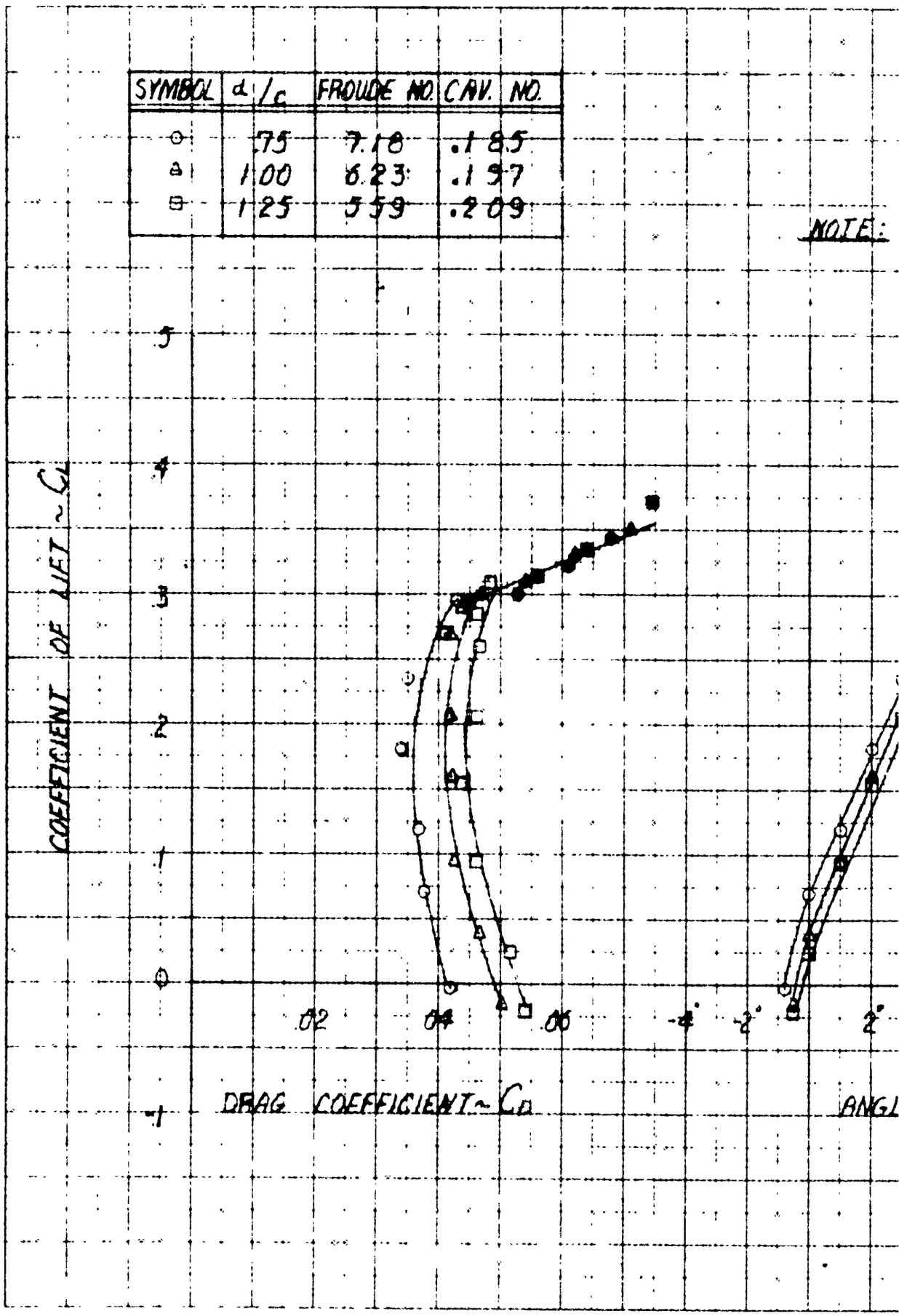


ANGLE OF ATTACK
DEGREES

PITCHING MOMENT COEFF
$C_{M_{c/4}}$

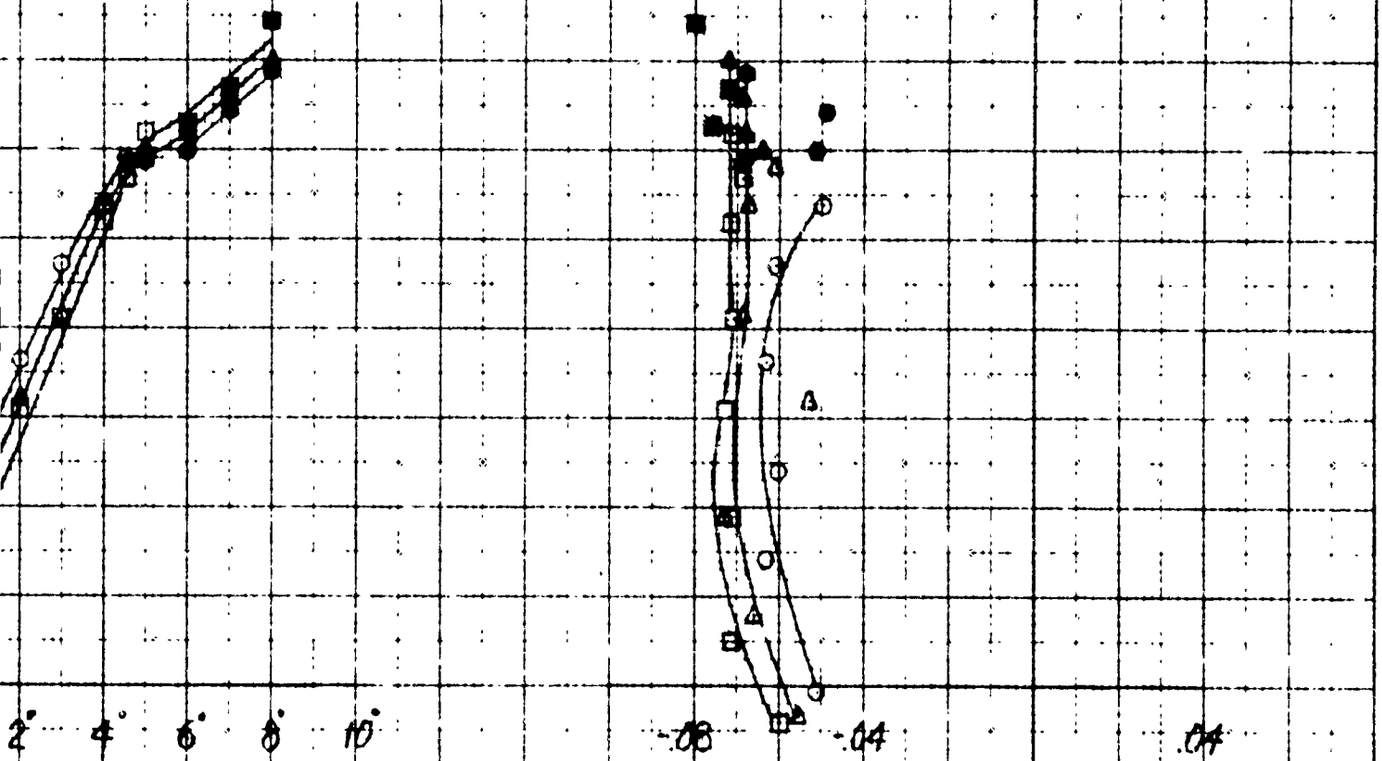
SYMBOL	d/c	FROUDE NO.	CAV. NO.
○	.75	7.18	.185
△	1.00	6.23	.197
□	1.25	5.59	.209

NOTE:



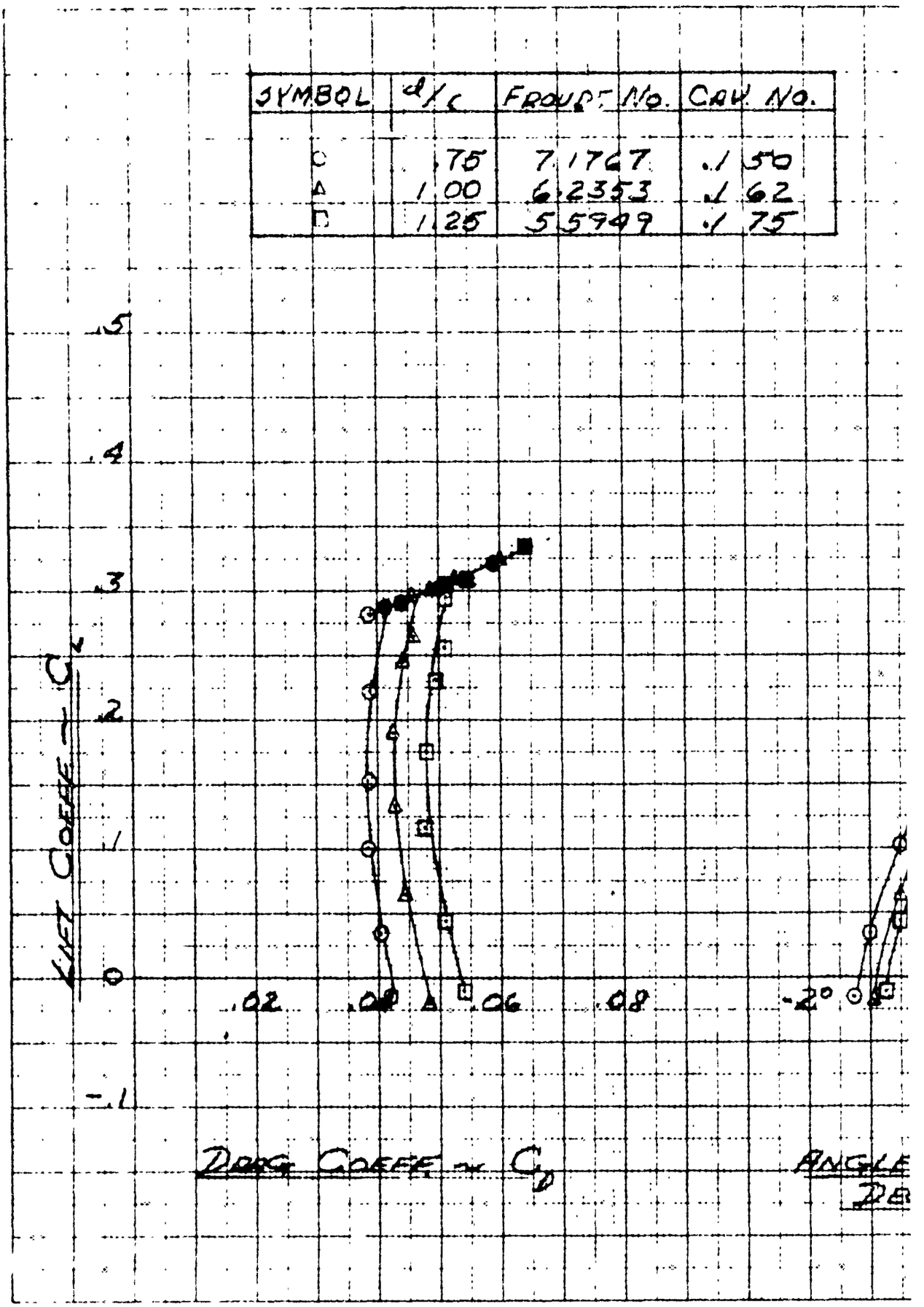
WHIRLING TANK TEST NO. 49
BU SHIPS FOIL NO 19
$S = 4.94\ IN^2$; MAC. = .110 FT.
V = 70 KTS

E:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



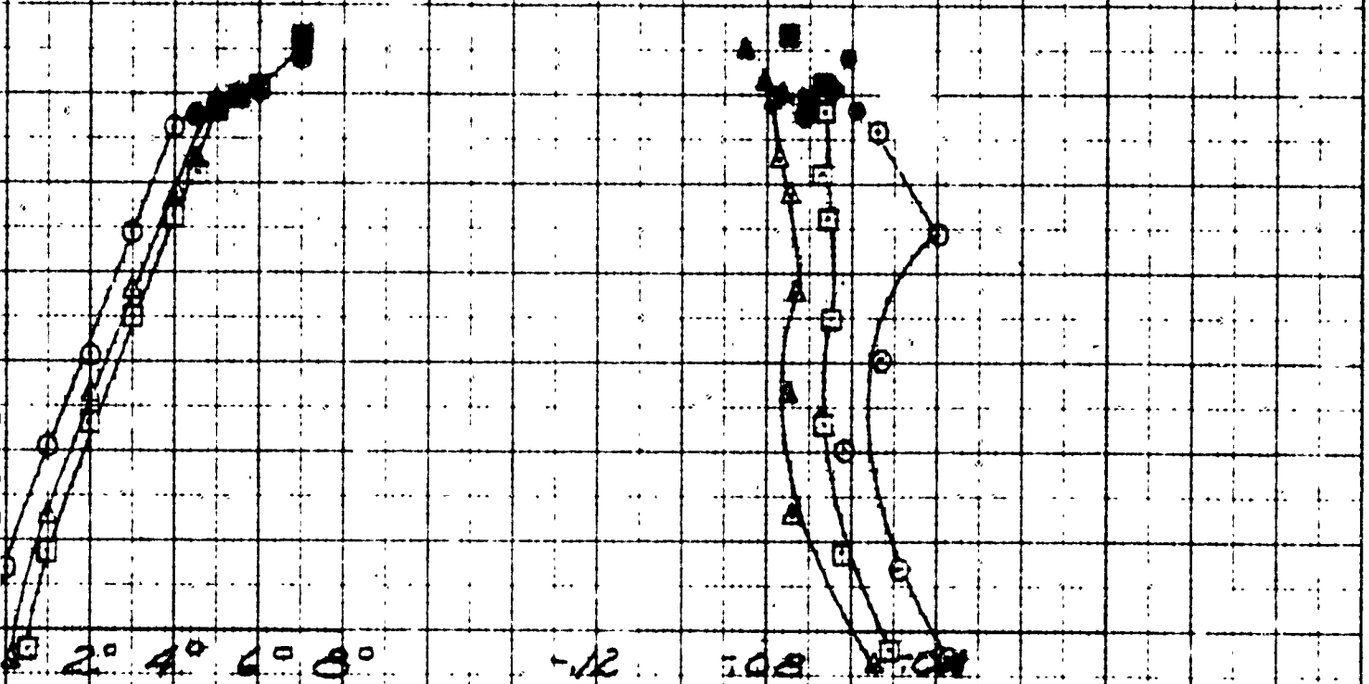
NGLE OF ATTACK ~ α ~ DEGREES PITCHING MOMENT COEFFICIENT ~ $C_{M_{c/4}}$

SYMBOL	d/c	FROUDE No.	CAV. No.
○	.75	7.1767	.1150
△	1.00	6.2353	.1162
□	1.25	5.5949	.1175



W.I.T. No 49 BuShips No. 19
M.A.C. = 11 FT. AREA = 4.940 "
VEL = 80 KTS

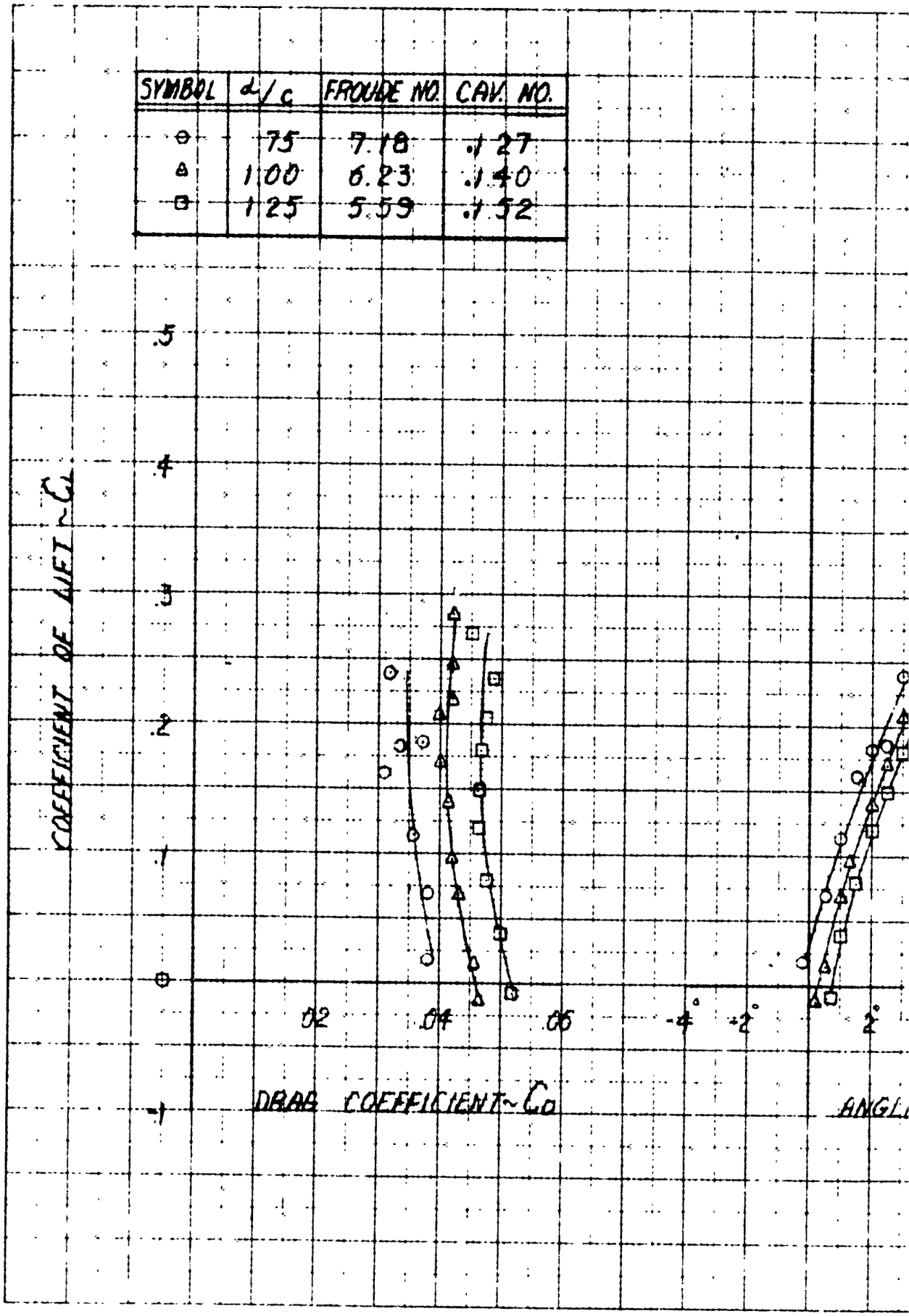
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW



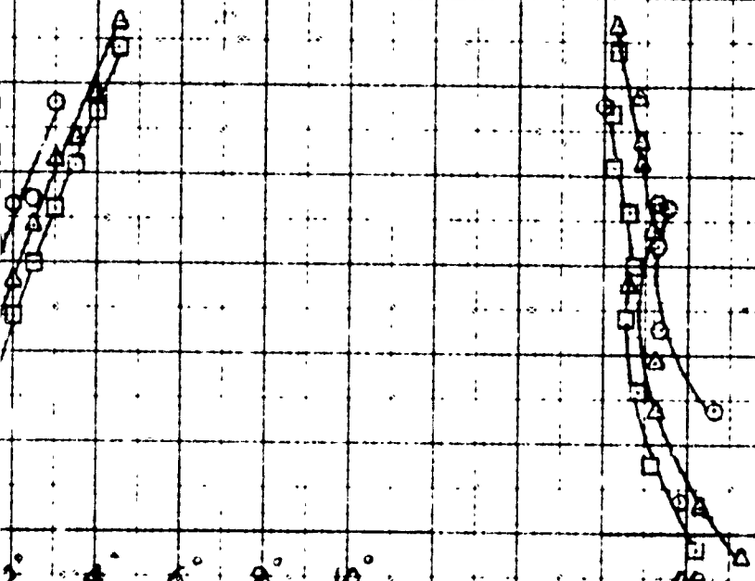
LE OF ATTACK
DEGREES

PITCHING MOMENT COEFF.
$C_{m_{c/4}}$

SYMBOL	ℓ/c	FROUDE NO.	CAV. NO.
○	75	7.18	.127
△	100	6.23	.140
□	125	5.59	.152



WHIRLING TANK TEST NO. 49
BU SHIPS FOIL NO. 19
S = 4.94 IN.²; MAC. = .110 FT.
V = 90 KTS.



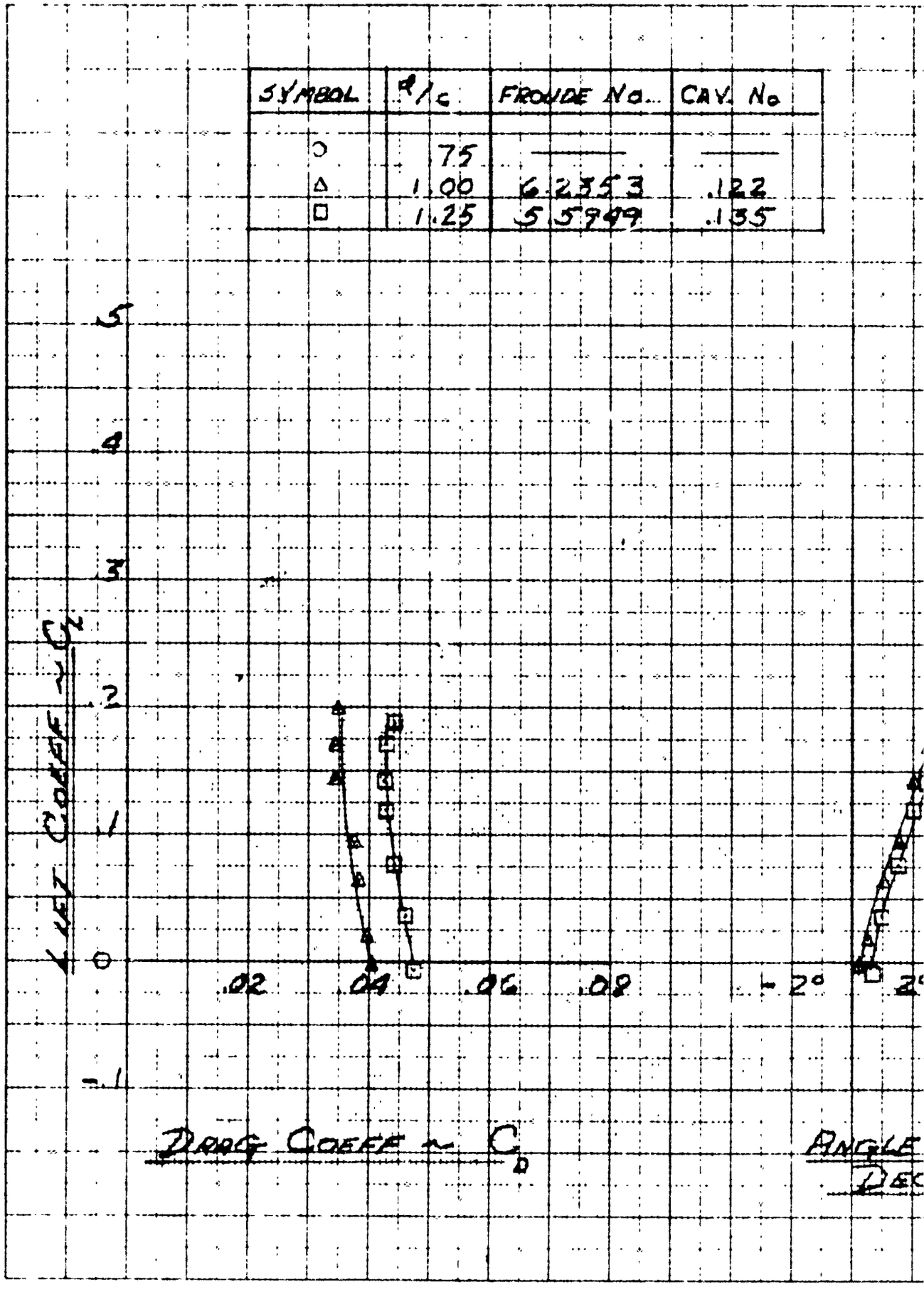
2° 4° 6° 8° 10°

ANGLE OF ATTACH - α - DEGREES

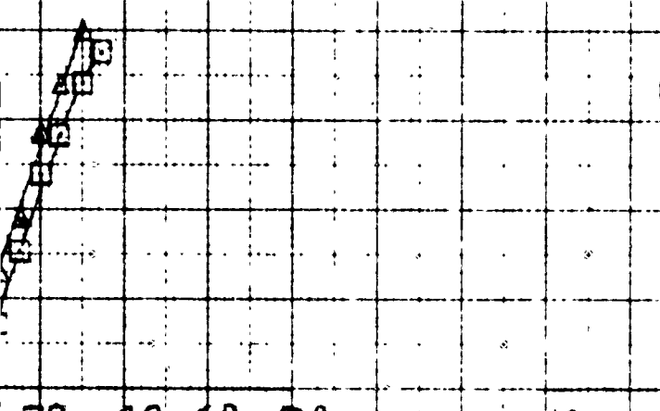
-.08 -.04 .04

PITCHING MOMENT COEFFICIENT - $C_{M_{c/4}}$

SYMBOL	R/c	FROUDE No.	CAV. No
○	.75	———	———
△	1.00	6.2353	.122
□	1.25	5.5999	.135



W.I.T. NO. 49 BUSHIPS FOIL NO. 19
M.A.C. = 11 FT AREA = 4.94 ft²
VEL = 96 KTS

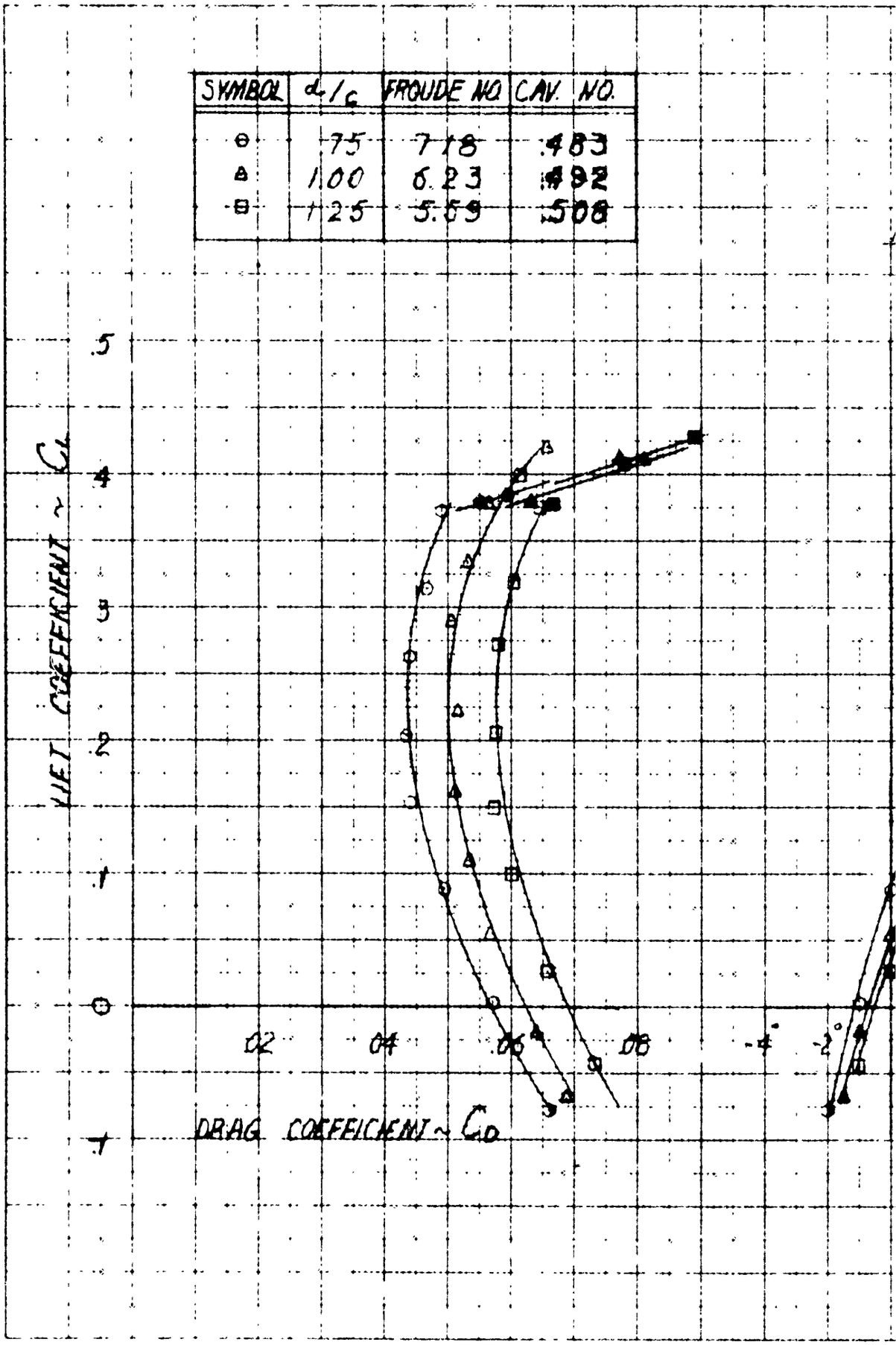


2° 4° 6° 8°

-.12 -.08 +.04

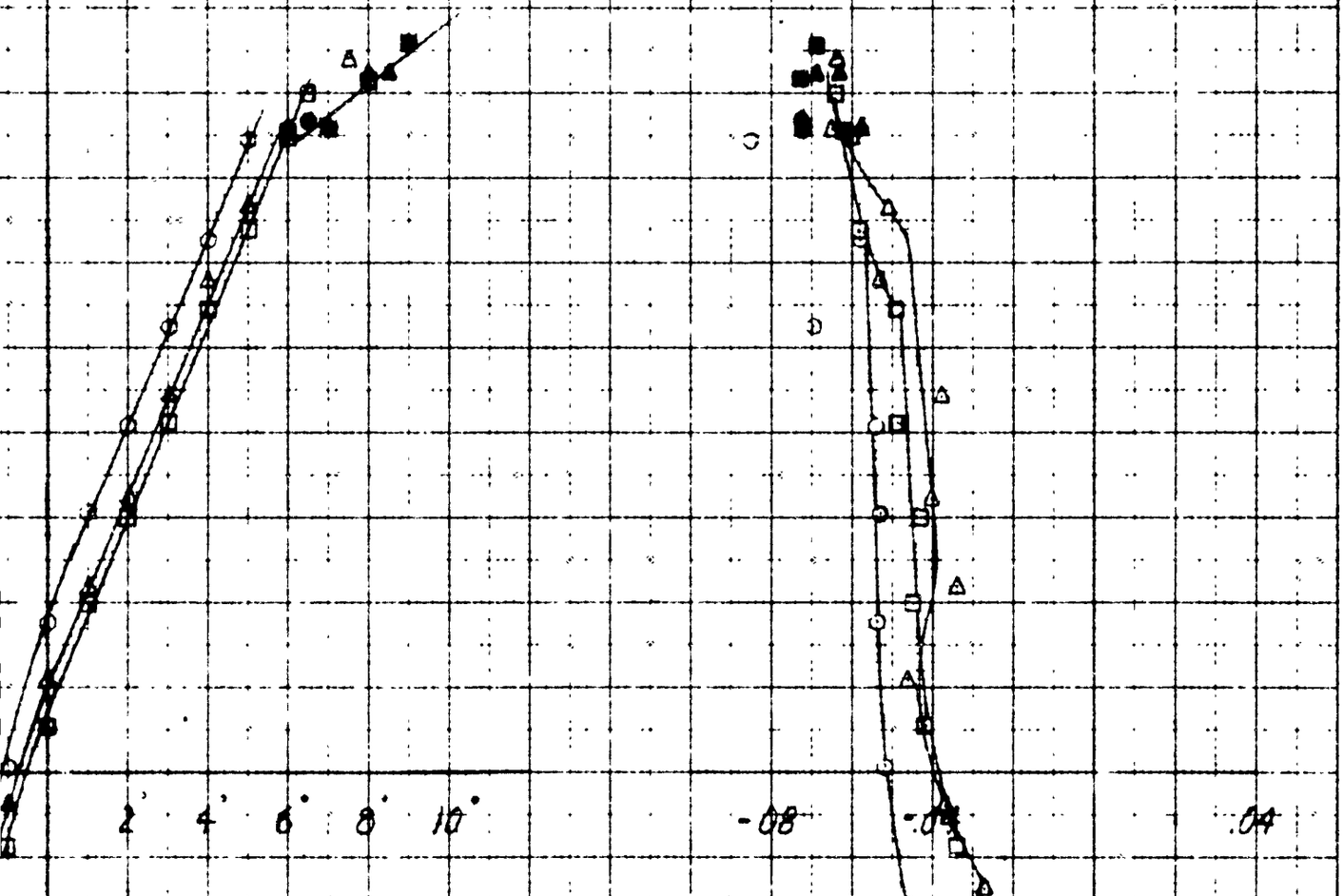
LE OF ATTACK
EGREES

PITCHING MOMENT COEFF
$C_{M_{c/4}}$


SYMBOL
d/c
FROUDE NO
CAV. NO.
.75
7.18
.483
1.00
6.23
.492
1.25
5.59
.506
LIFT COEFFICIENT ~ CL
DRAG COEFFICIENT ~ CD
.5
4
3
2
1
0
-1
02
04
06
08
-4
-2°

WHIRLING TANK TEST NO. 50
BU SHIPS FOIL NO. 20
M.A.C. = .110 FT. ; S = 4.94 IN²
V = 40 M.P.S.

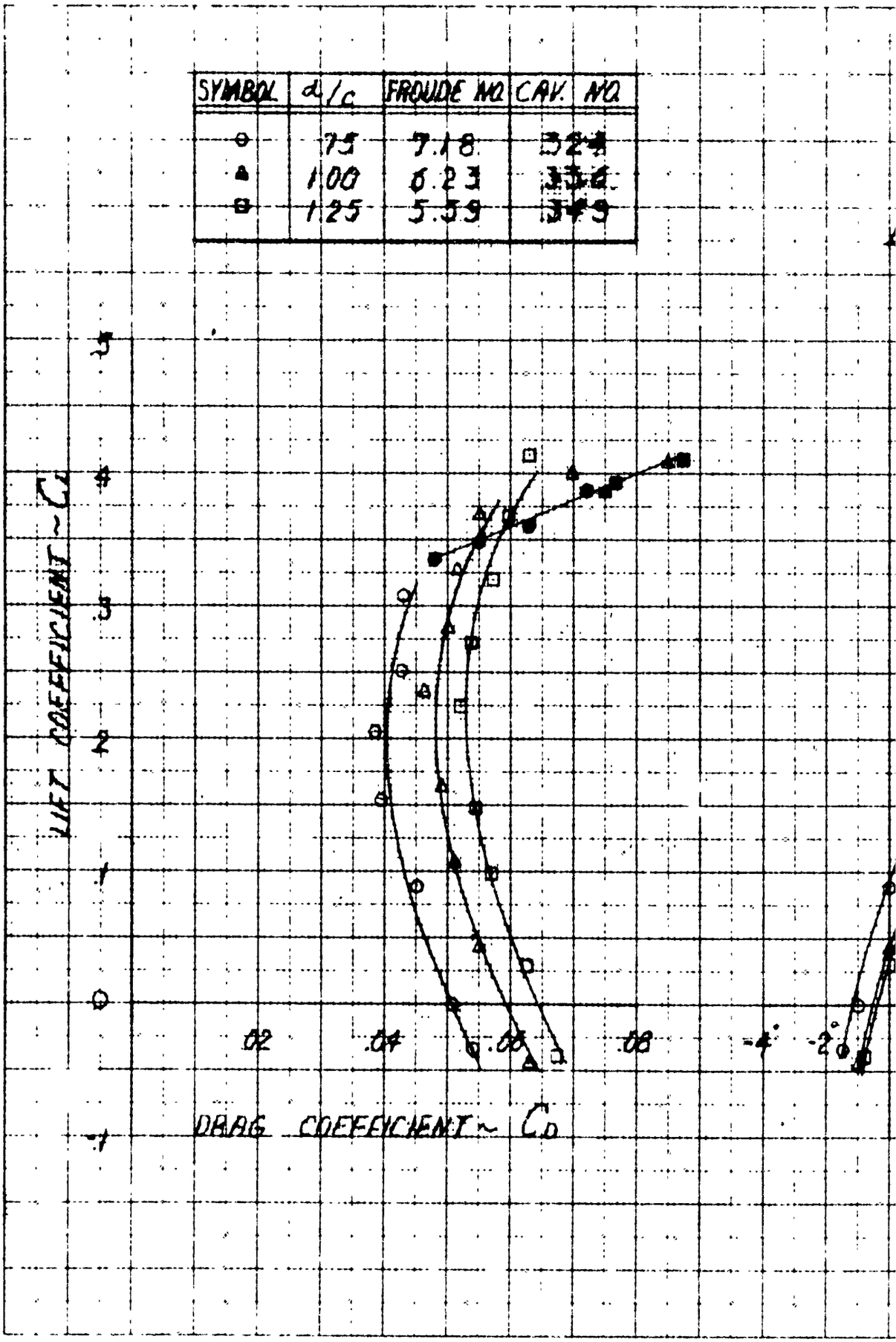
NOTE:
1 DARKENED POINTS INDICATE VENTED FLOW



ANGLE OF ATTACK - α DEGREES

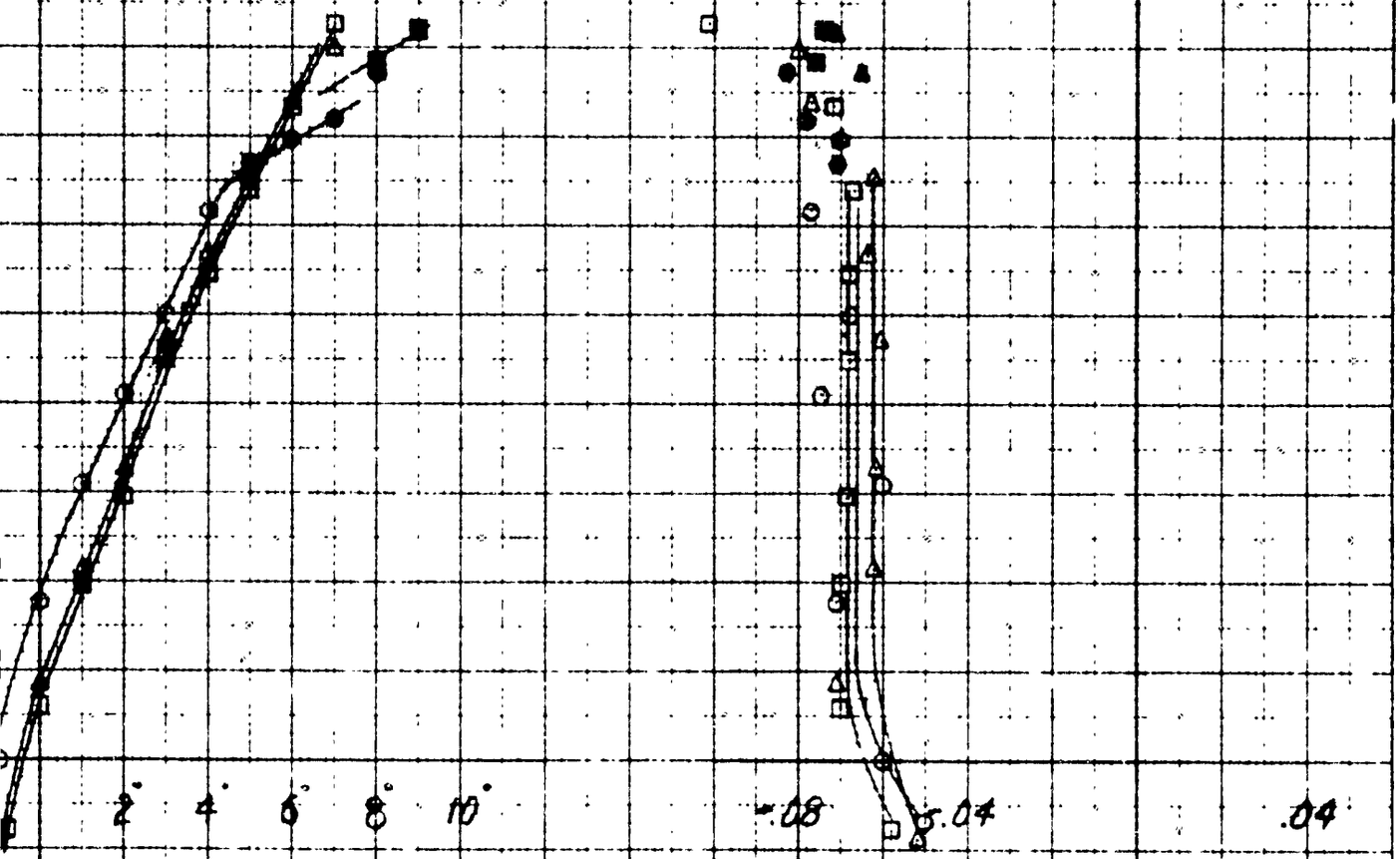
PITCHING MOMENT COEFFICIENT - $C_{M_{c/4}}$

SYMBOL	d/c	FROUDE NO	CAV. NO
○	.75	7.18	.324
△	1.00	6.23	.334
□	1.25	5.59	.349



WHIRLING TANK TEST NO. 50
BU SHIPS FOIL NO. 20
MAC = .110 FT ; S = 4.94 IN²
V = 50 KTS.

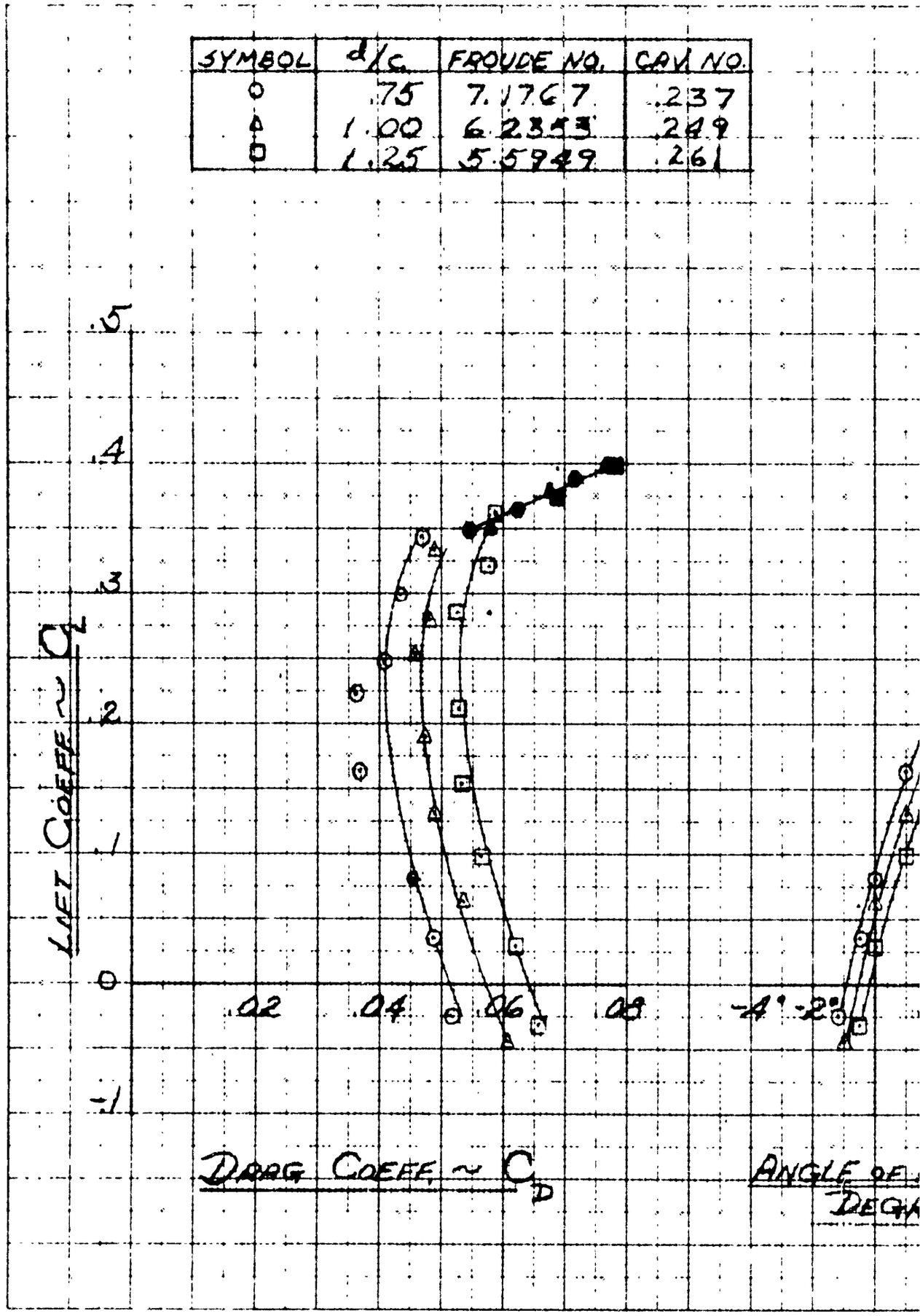
NOTE:
1. DARKENED POINTS INDICATE VENTED FLOW.



ANGLE OF ATTACK ~ α ~ DEGREES

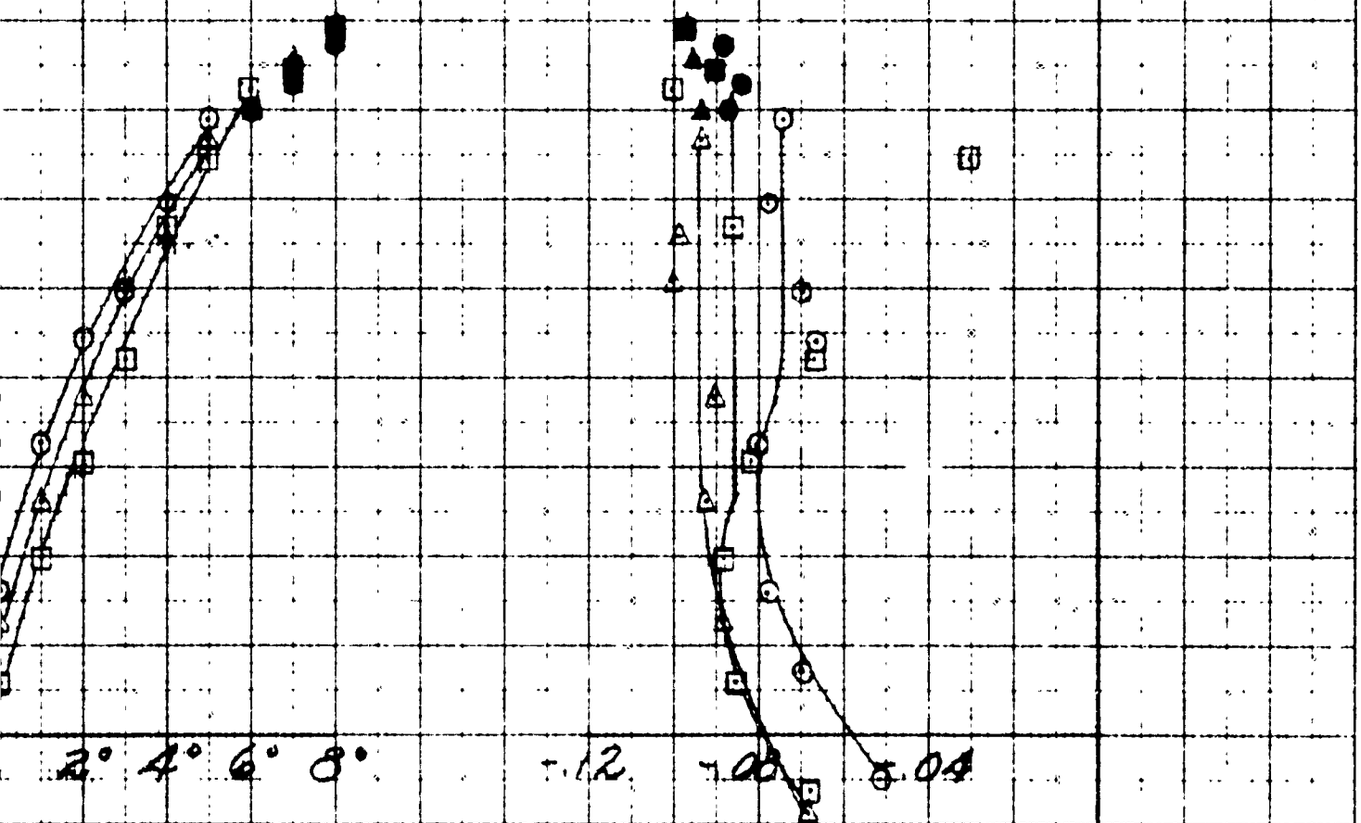
PITCHING MOMENT COEFFICIENT ~ $C_{M_{c/4}}$

SYMBOL	d/c	FROUDE NO.	CAV NO.
○	.75	7.1767	.237
△	1.00	6.2353	.249
□	1.25	5.5949	.261



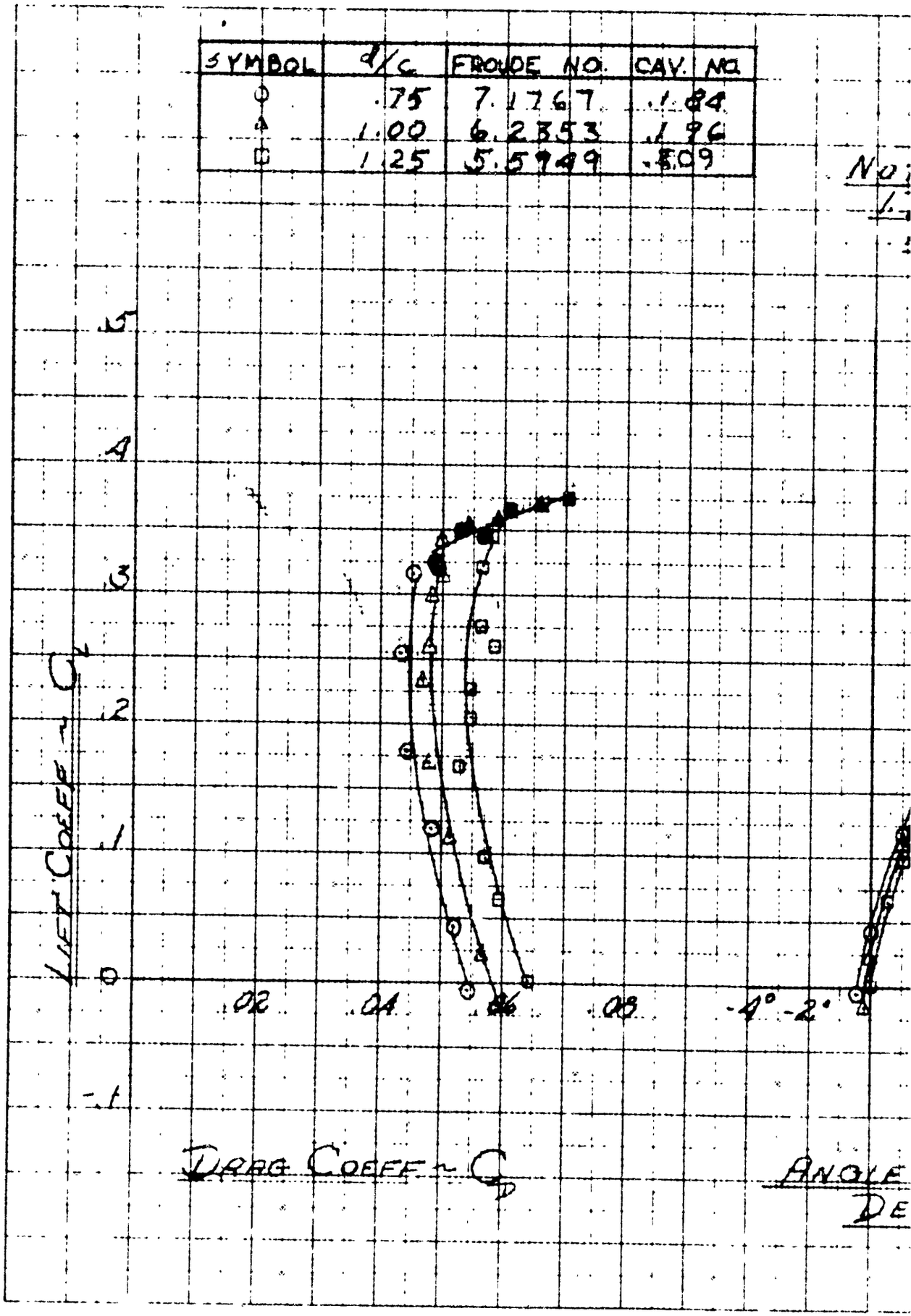
W. I. T. No. 50, Buships Foil No. 20
M.A.C. = 110 Ft. Area = 4.94 0"
Vel. = 60 Kts

NOTE:
1. Darkened Symbols
Indicate Vented Flow



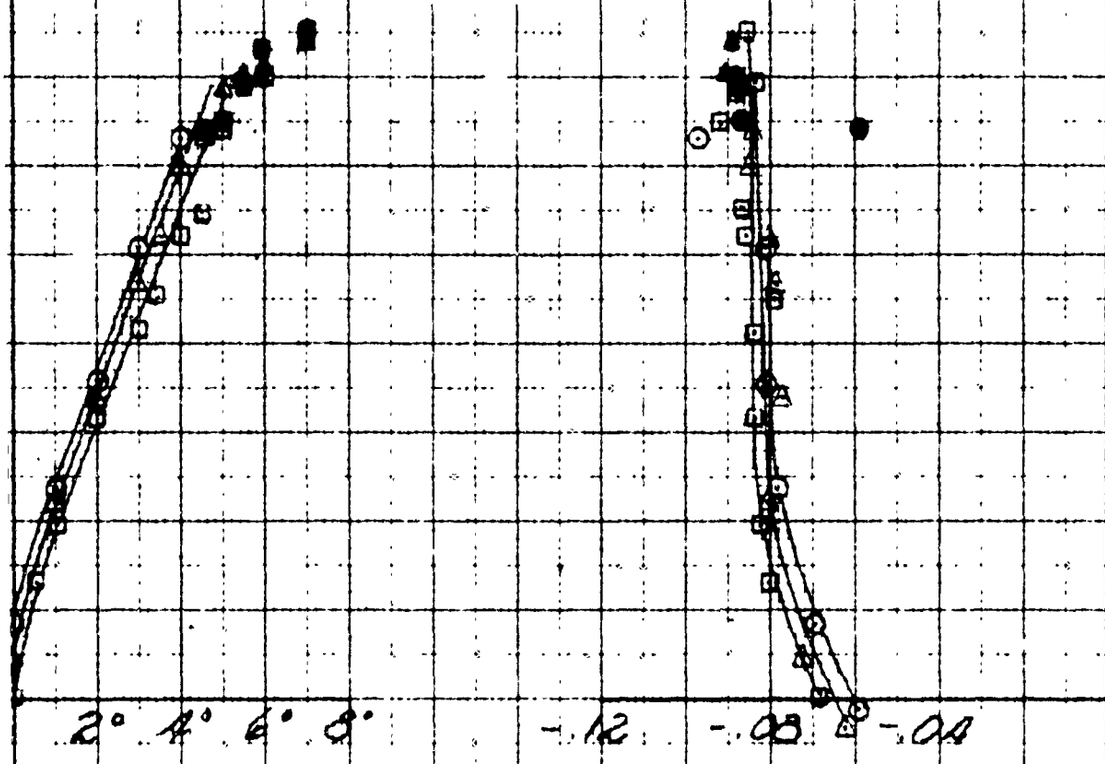
...de Attack
...grees

Pitching Moment Coeff
$C_{M_{c/4}}$


SYMBOL
d/c
FROUDE NO.
CAV. No
.75
7.1767
1.84
1.00
6.2353
1.96
1.25
5.5949
5.09
No
LIFT COEFF - C_L
5
4
3
2
1
0
-1
.02
.04
.06
.08
-1°
-2°
DRAG COEFF - C_D
ANGLE
DE

W. T. T. No. 50 BuShips Foil No. 20
M.A.C. = .110 FT AREA = 4.94 □"
VEL = 70 KTS

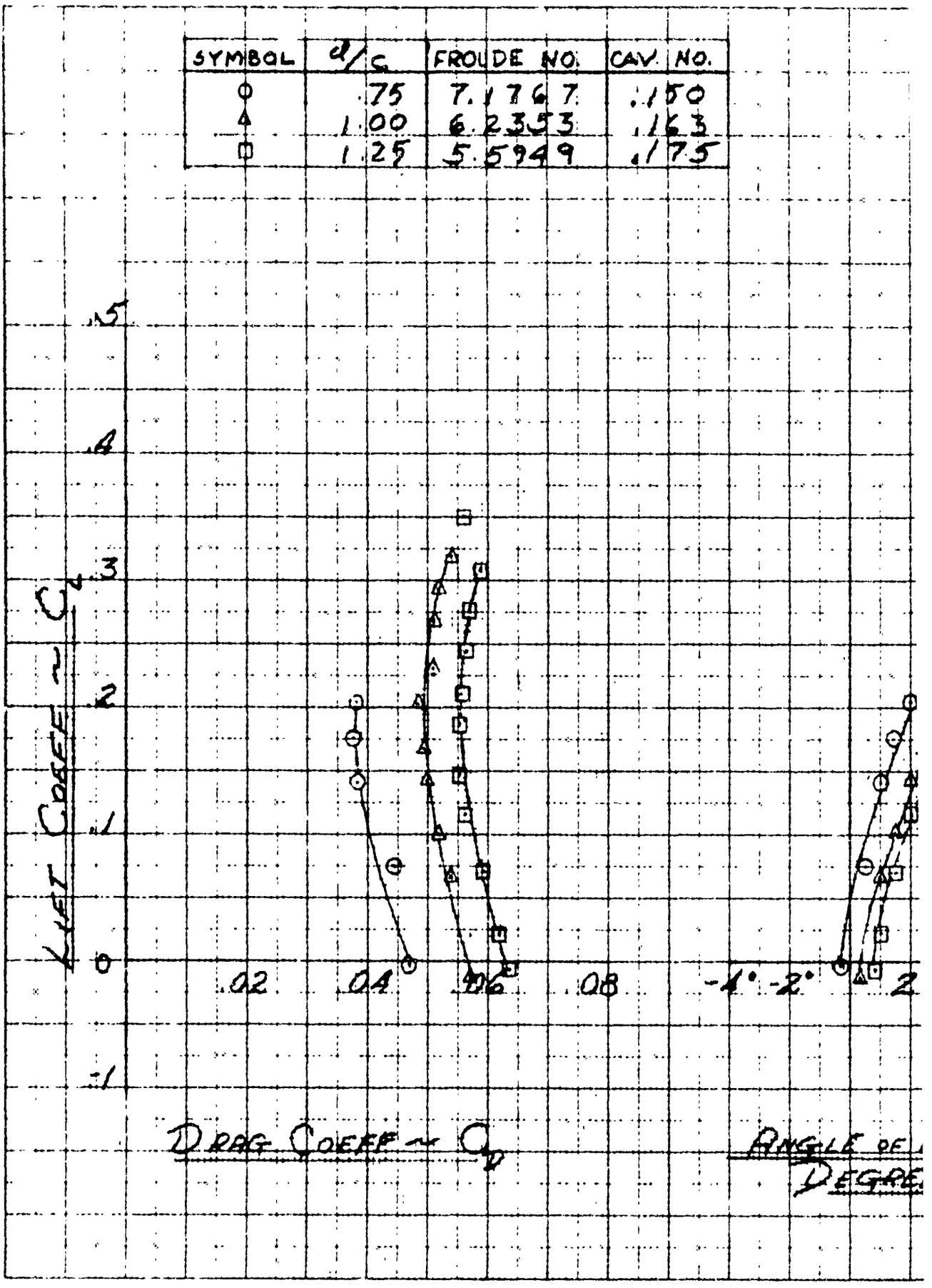
OTE:
1. DARKENED SYMBOLS
INDICATE VENTED FLOW.



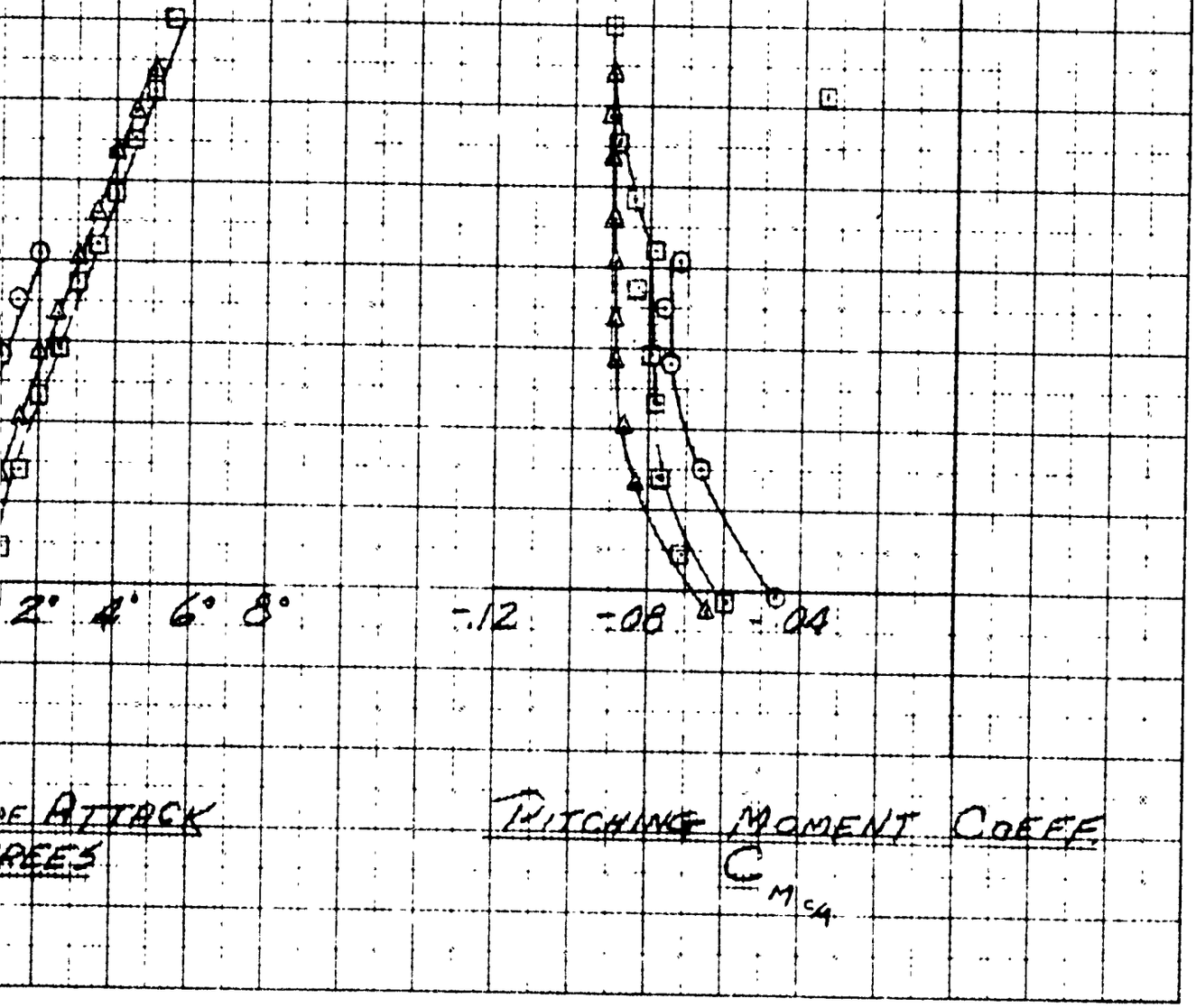
LE OF ATTACK
DEGREES

PITCHING MOMENT COEFF
$C_{M_{c/4}}$

SYMBOL	d/c	FROUDE NO.	CAV. NO.
○	.75	7.1767	.150
△	1.00	6.2353	.163
□	1.25	5.5949	.175



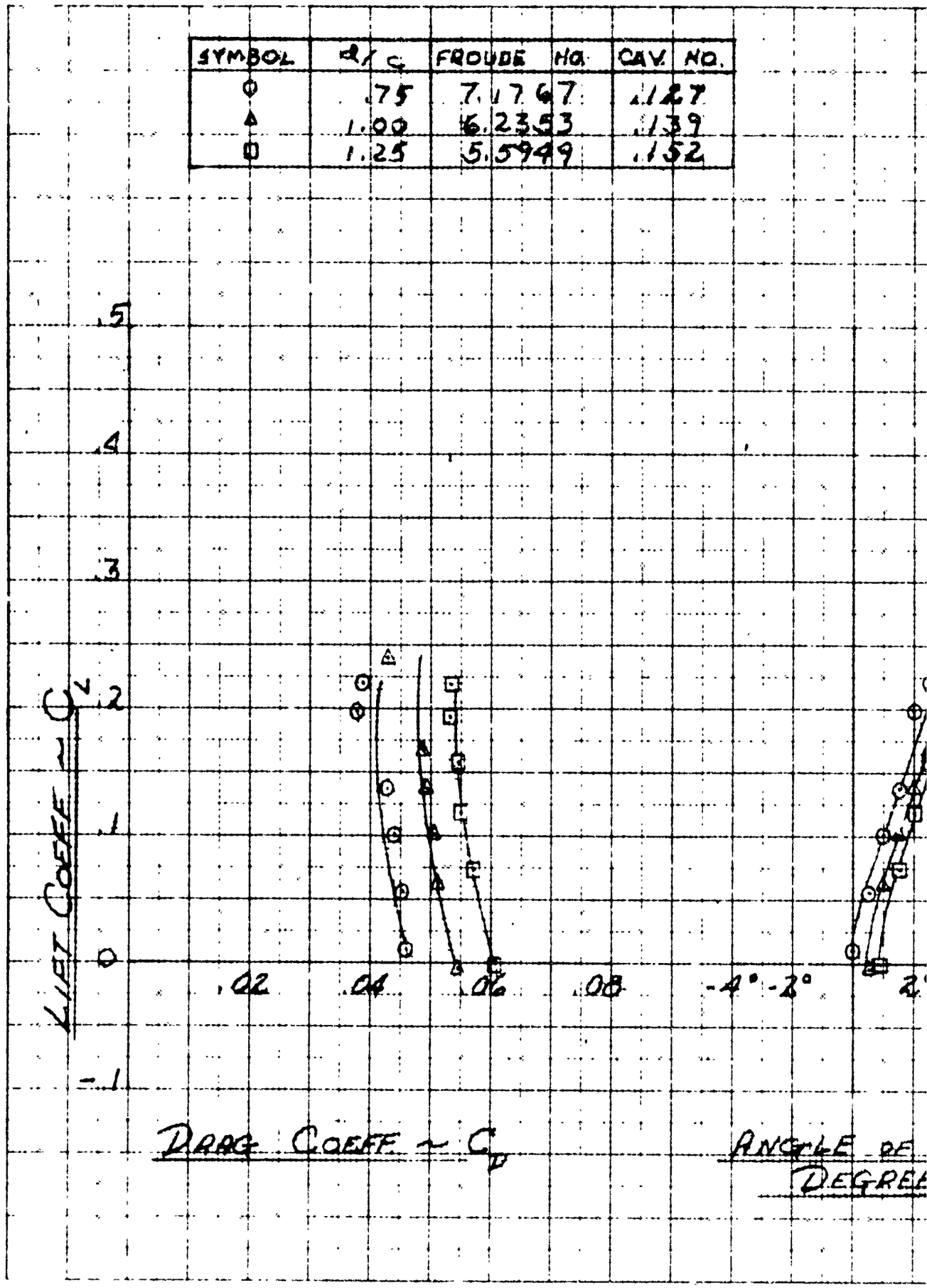
W.I.T No. 50 BuShips Foil No. 20
M.A.C. = .110 FT AREA = .98 FT^2
VEL = 80 KTS



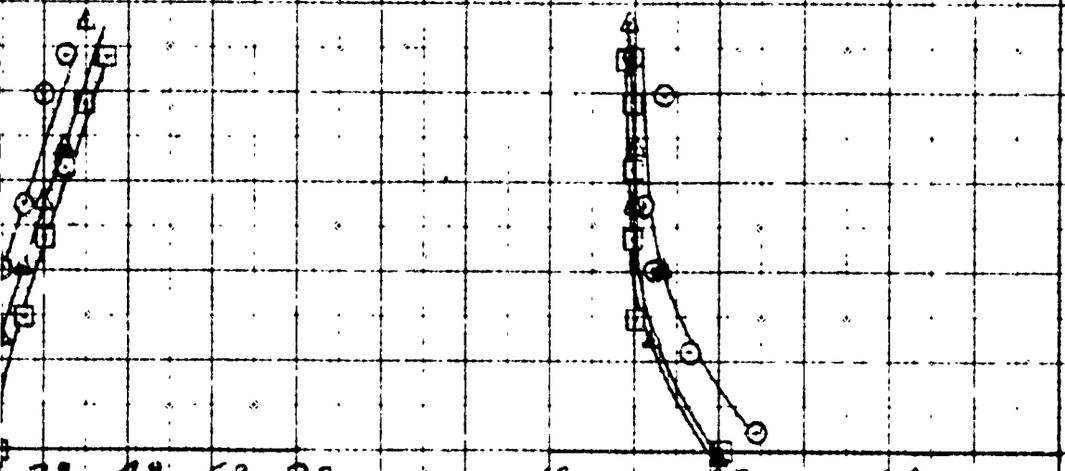
OF ATTACK
REES

PITCHING MOMENT COEFF
$C_{M_{C/4}}$

SYMBOL	ℓ / c	FROUDE NO.	CAV. NO.
○	.75	7.1767	.187
△	1.00	6.2353	.139
□	1.25	5.5949	.152



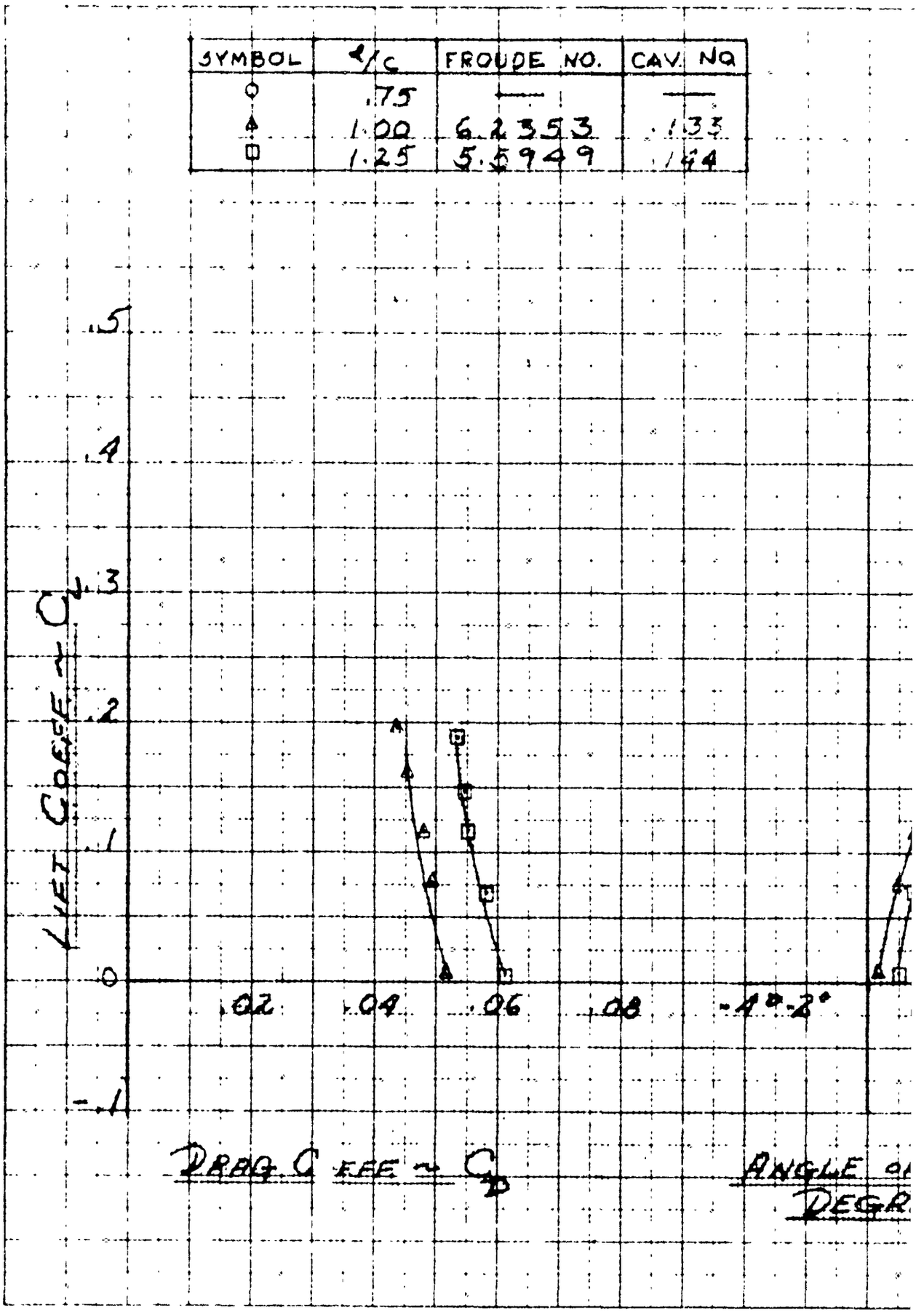
W.T.T. No. 50 Buships Foil No. 20
M.A.C. = .110 FT. AREA = 4.94 □"
VEL. = 90 KTS



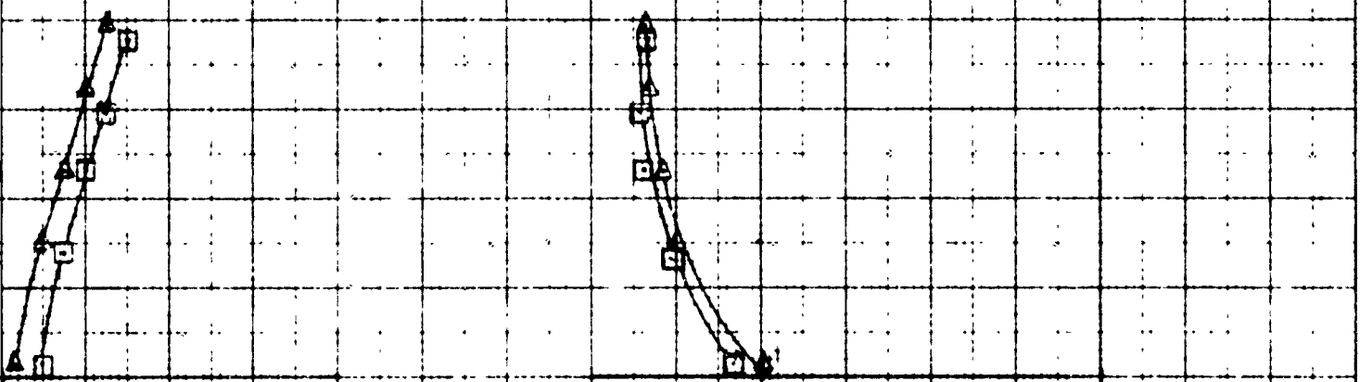
OF ATTACK
REES

PITCHING MOMENT COEFF
$C_{M_{C/4}}$

SYMBOL	ℓ/c	FROUDE NO.	CAV. NO
○	.75	—	—
△	1.00	6.2353	.133
□	1.25	5.5949	.144

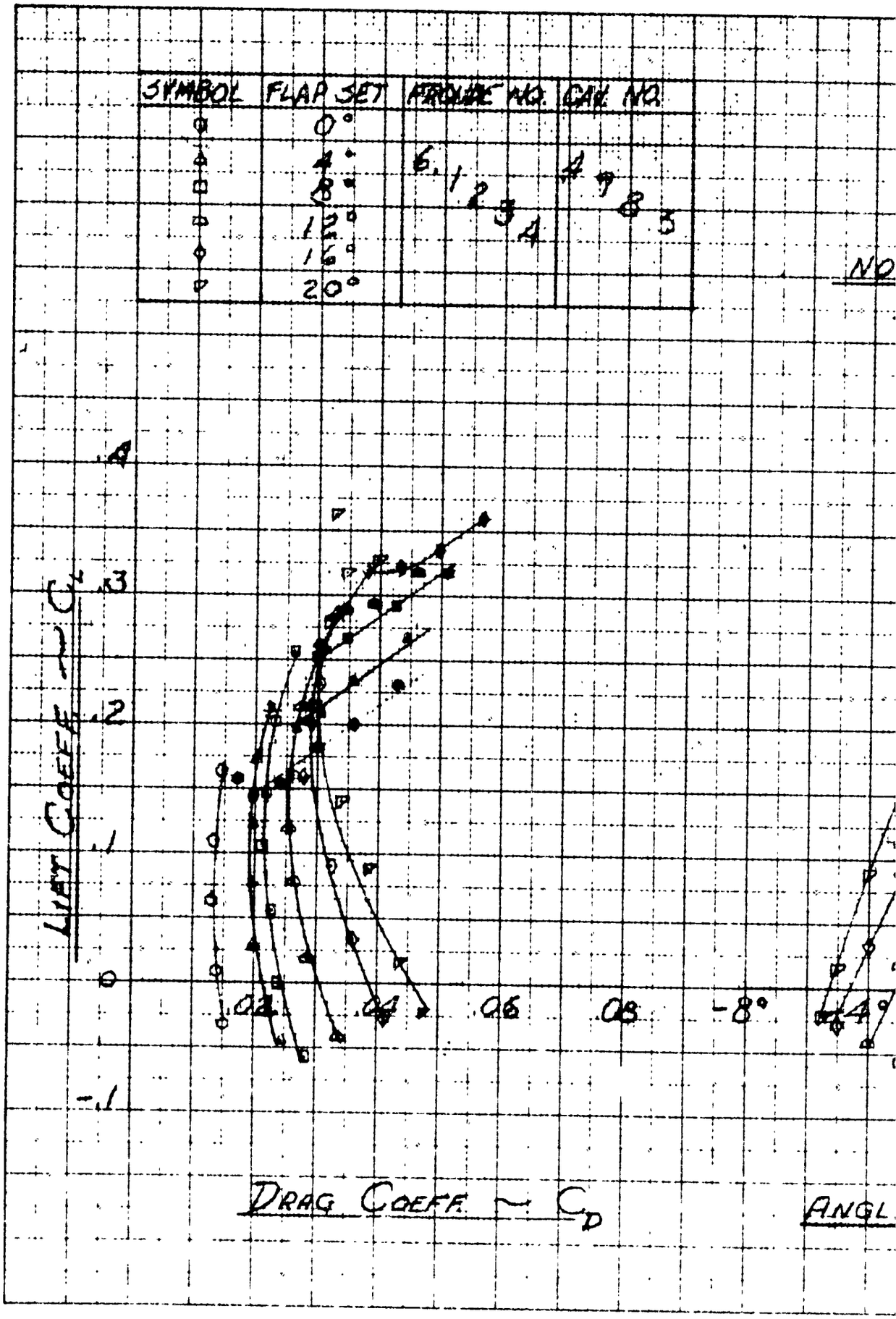


W.I.T. No. 50 BuShips Foil No. 20
M.A.C. = .110 Ft AREA = 4.940 "
VEL = 95 KTS



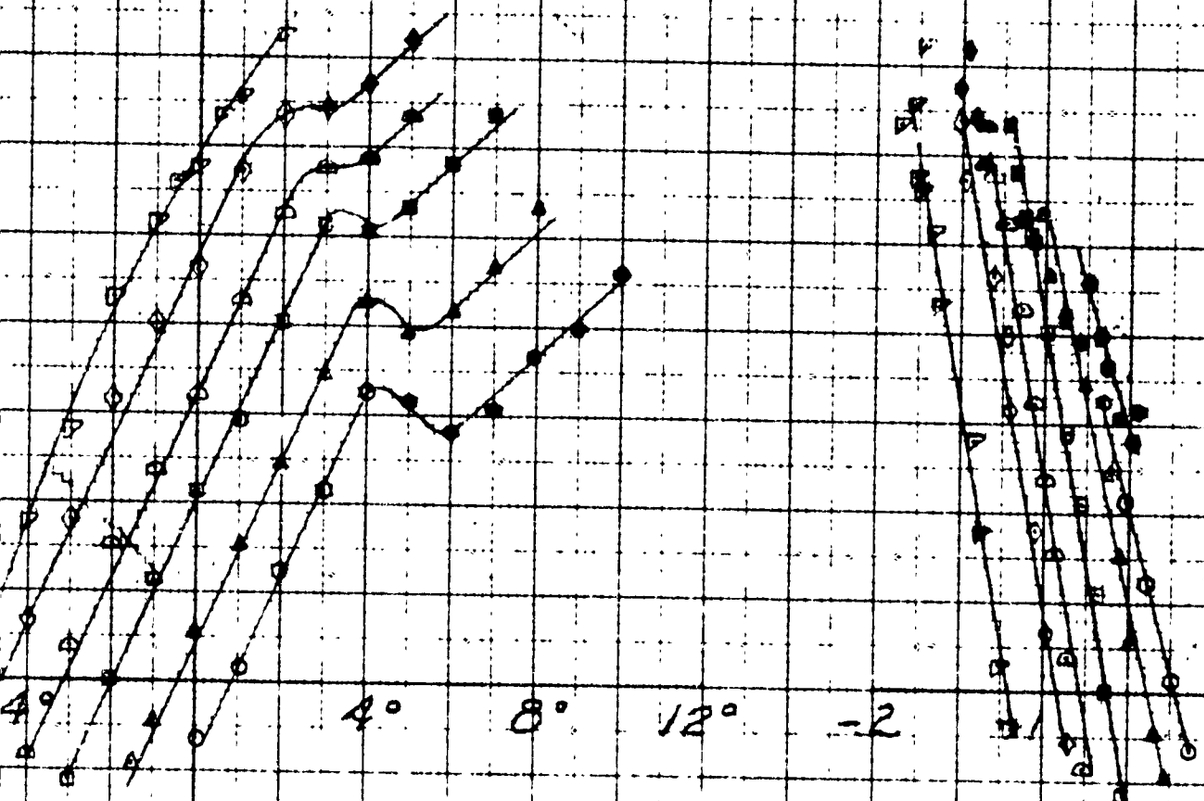
α ATTACK
DEGREES

PITCHING MOMENT COEFF.
$C_{M_{c/4}}$


SYMBOL
FLAP SET
AIRFOIL NO.
CAL NO.
0°
4°
8°
12°
16°
20°
6
1
2
3
4
4
7
8
5
NO
.4
.3
.2
.1
0
-.1
LIFT COEFF. ~ C_L
.02
.04
.06
.08
-8°
4°
DRAG COEFF. ~ C_D
ANGL

WHIRLING TANK TEST NO. 42
BUSHIPS FOIL NO. 13
MAC. = 1.52 FT. AREA = 8.0" d/c = .75
VEL = 40 KTS

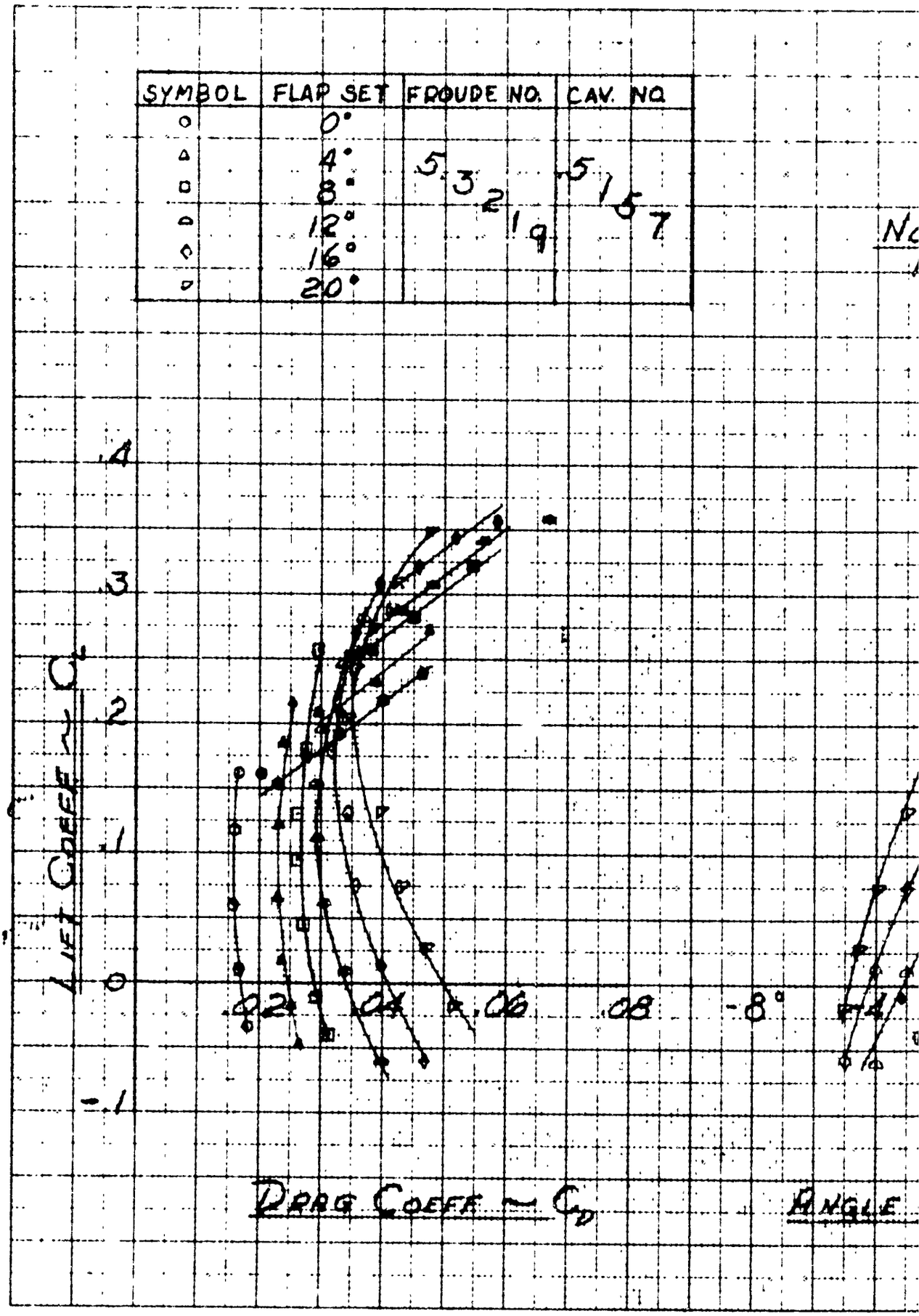
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW



-4° 0° 4° 8° 12° -2

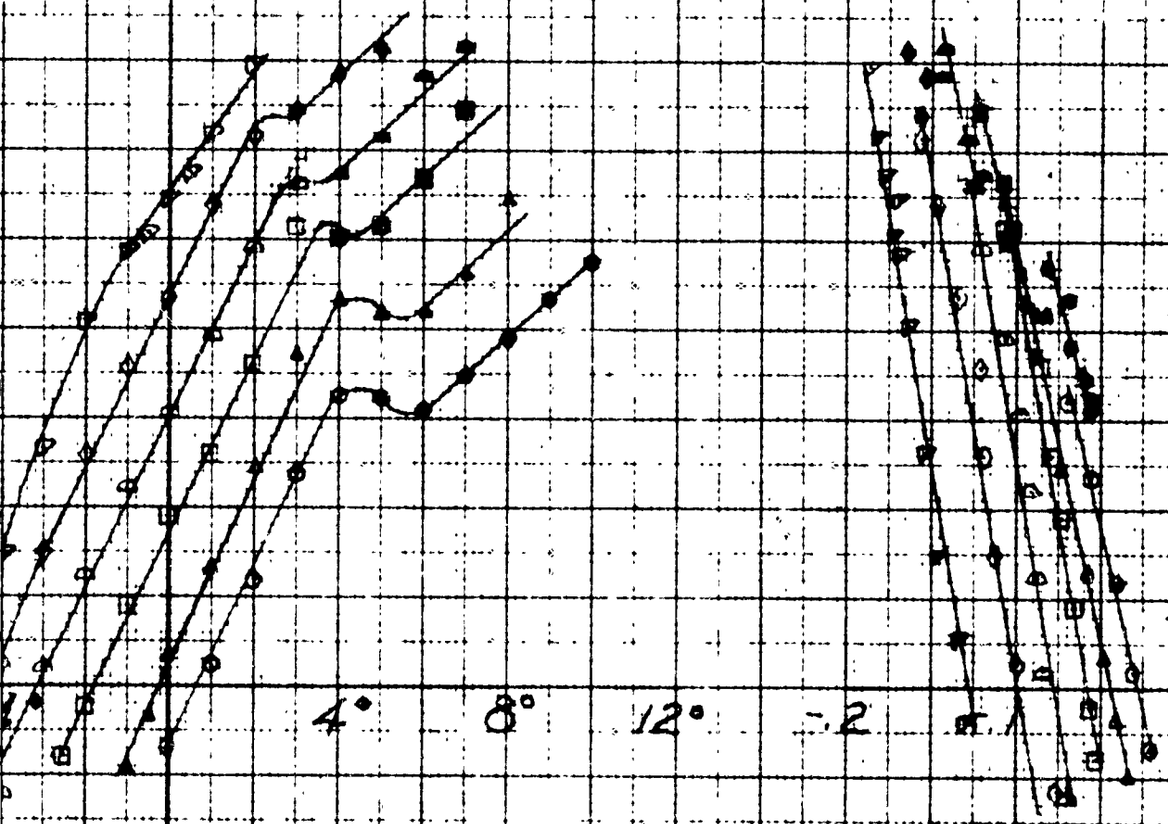
IGLE OF ATTACK — DEGREES

PITCHING MOMENT COEFF. — $C_{M_{c/4}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV. NO.
0°
4°
8°
12°
16°
20°
5 3 2 1 9
.5 1 5 7
.4
.3
.2
.1
0
-.1
LIFT COEFF ~ C_L
.02
.04
.06
.08
-8°
DRAG COEFF ~ C_D
ANGLE

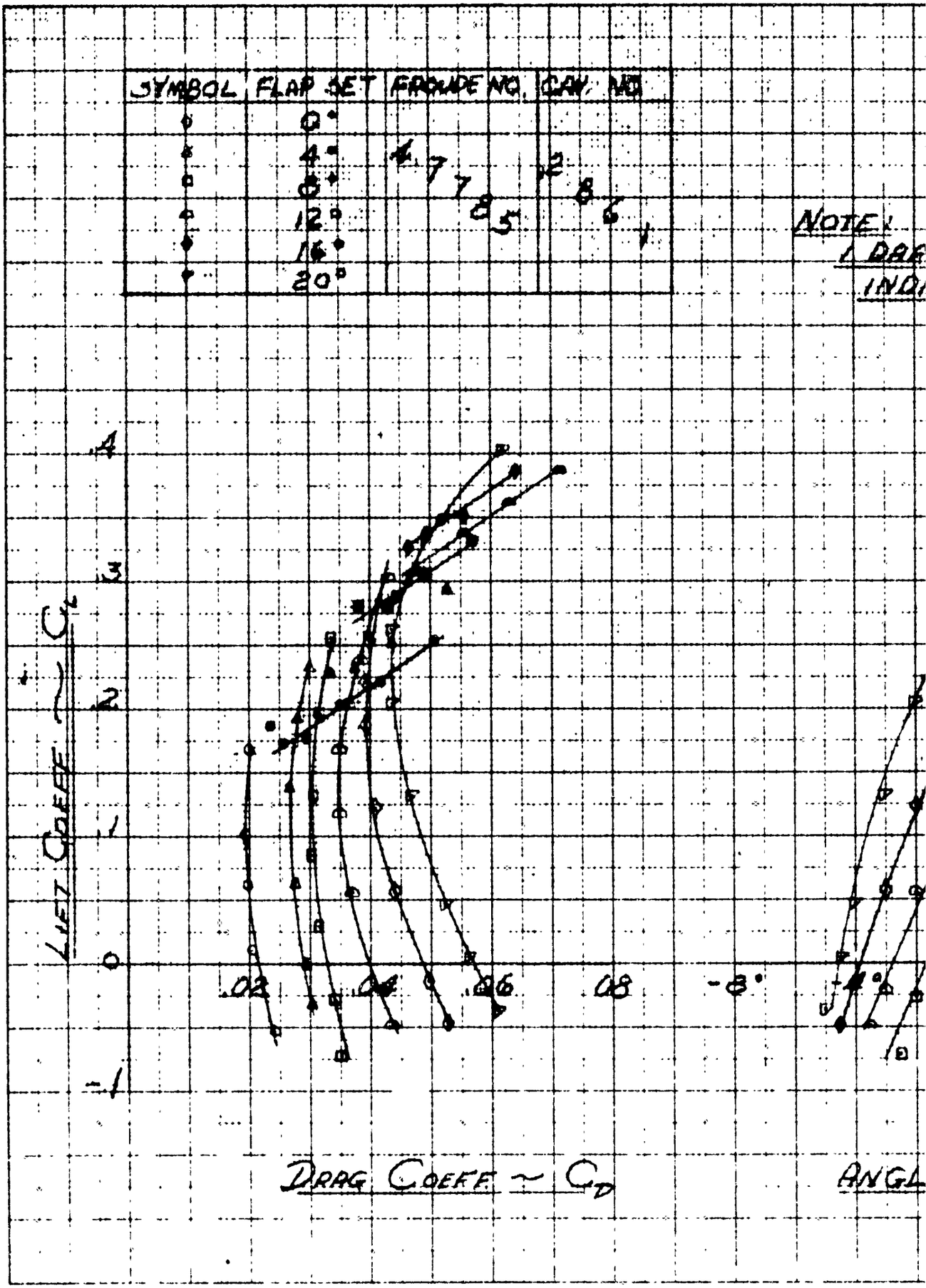
WHIRLING TANK TEST No. 42
BUSHIPS FOIL No. 13
M.A.C. = 152 FT AREA = 8□" d/c = 1.00
VEL = 40 KTS

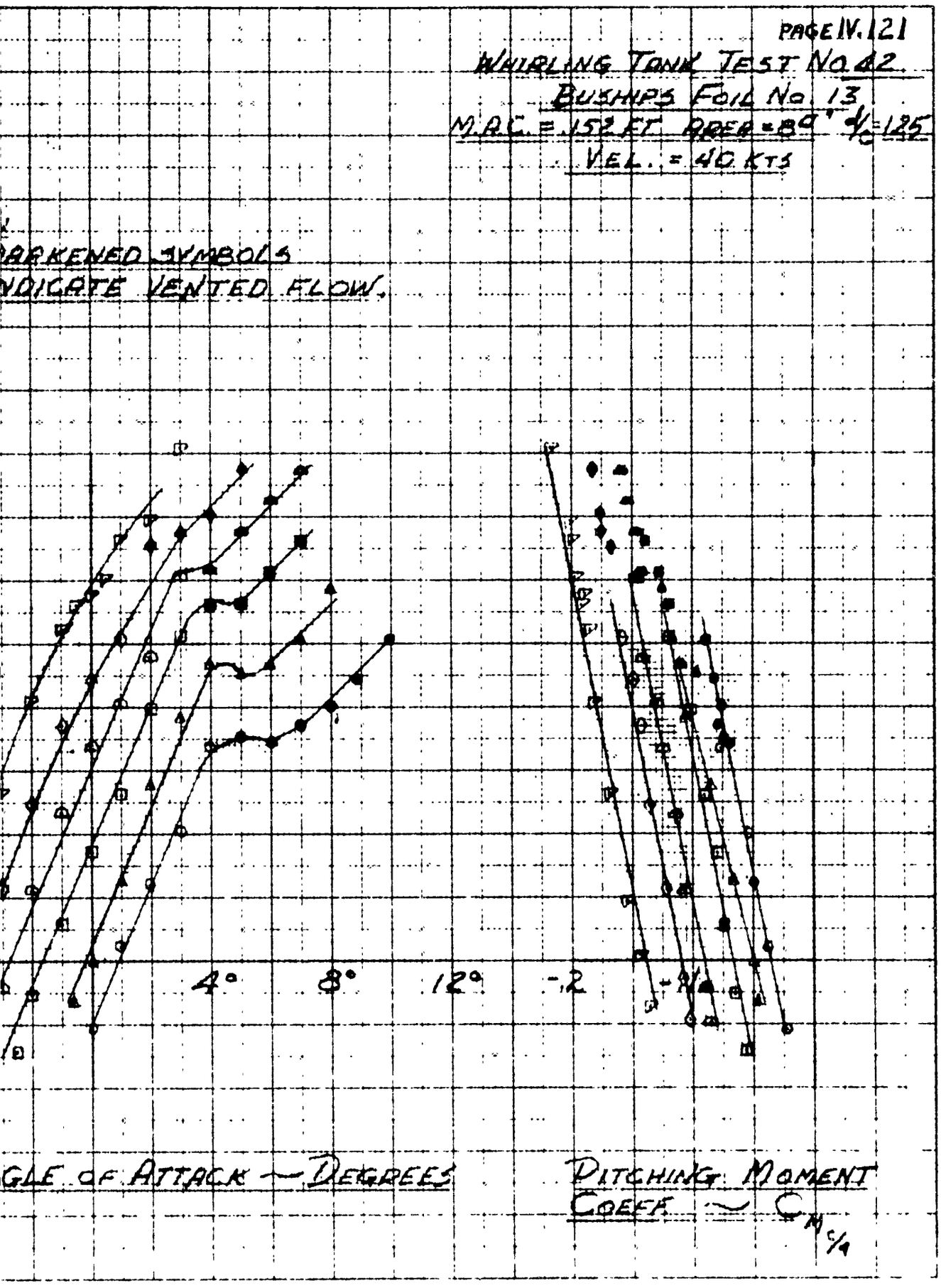
NOTE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.

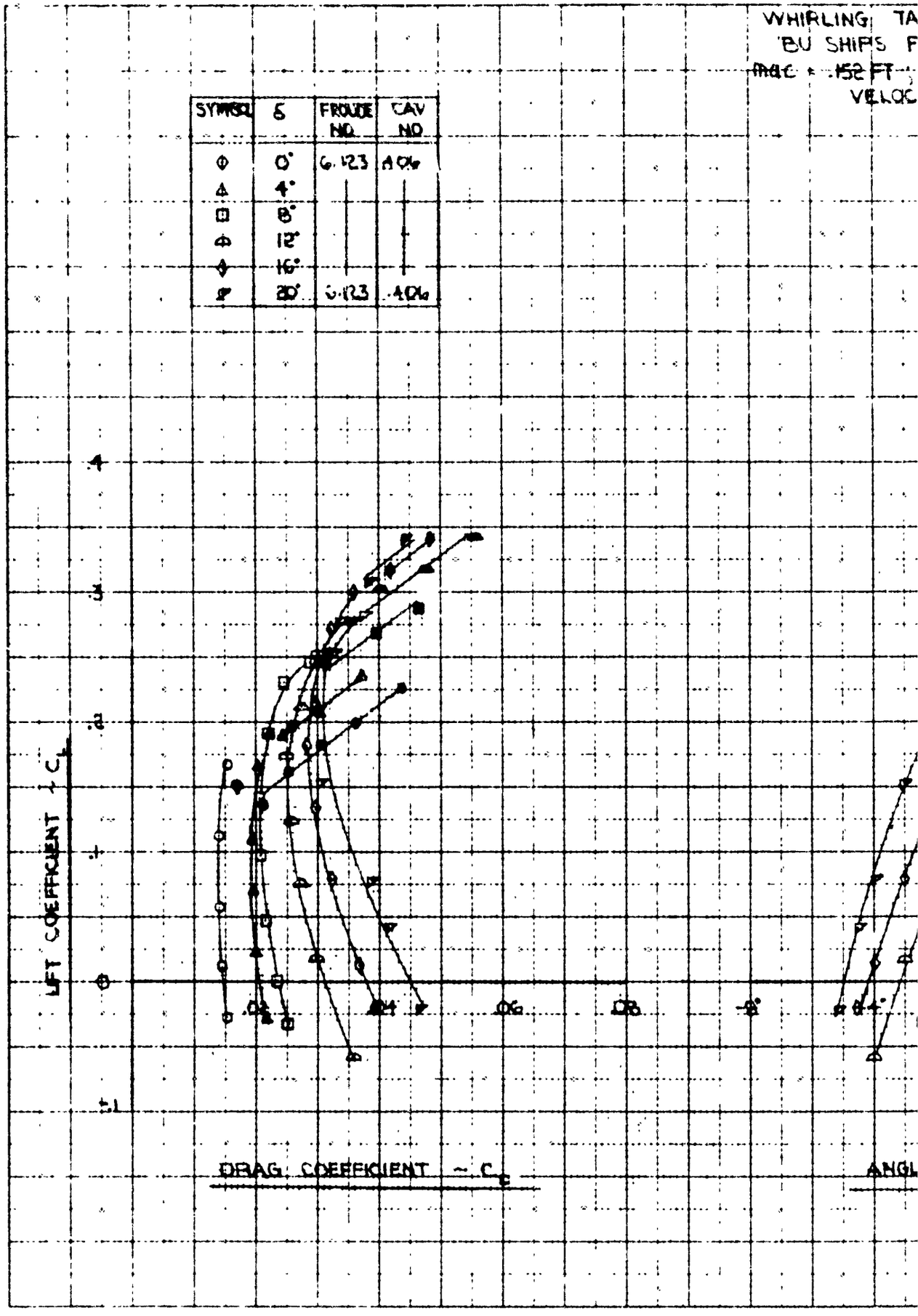


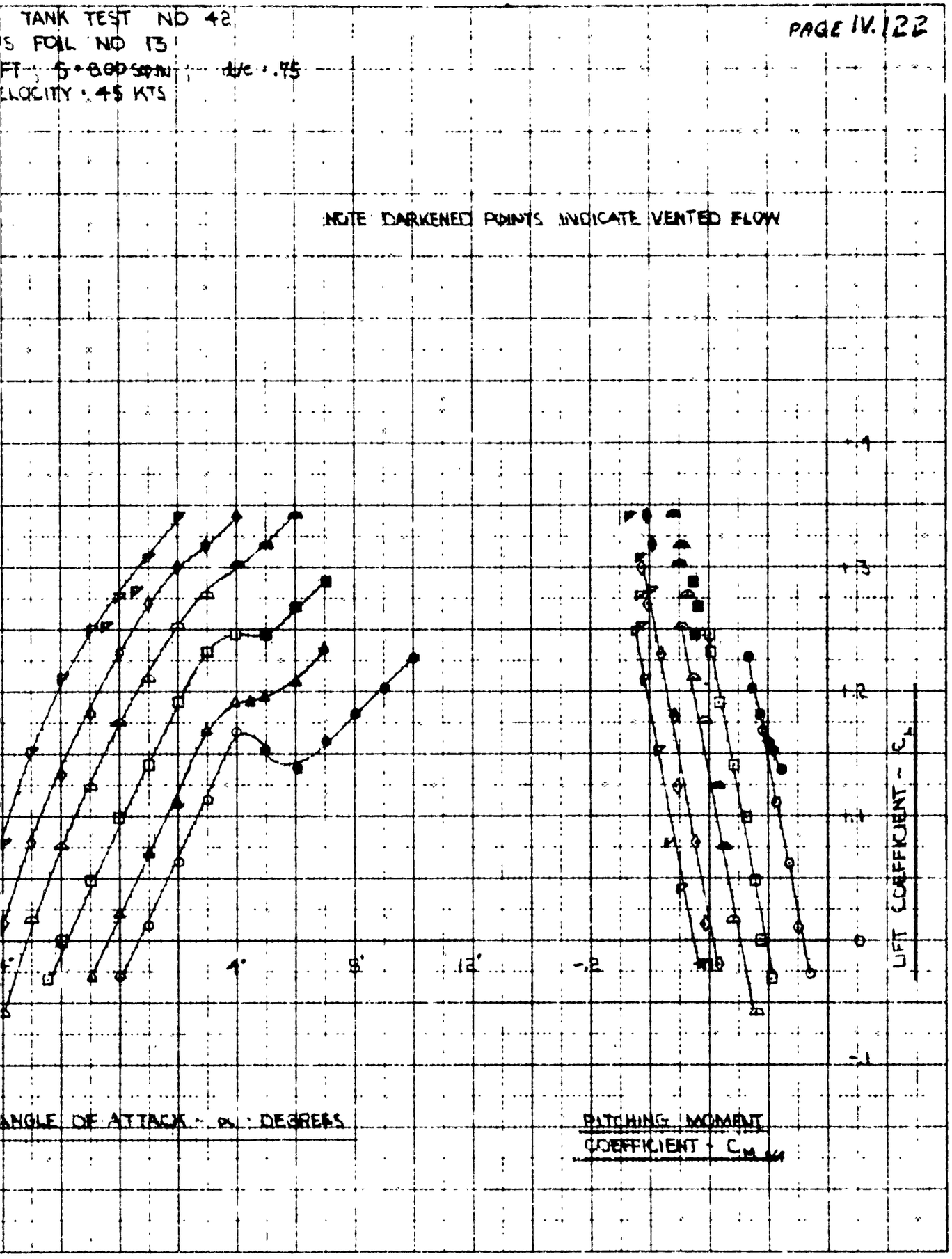
E OF ATTACK ~ DEGREES

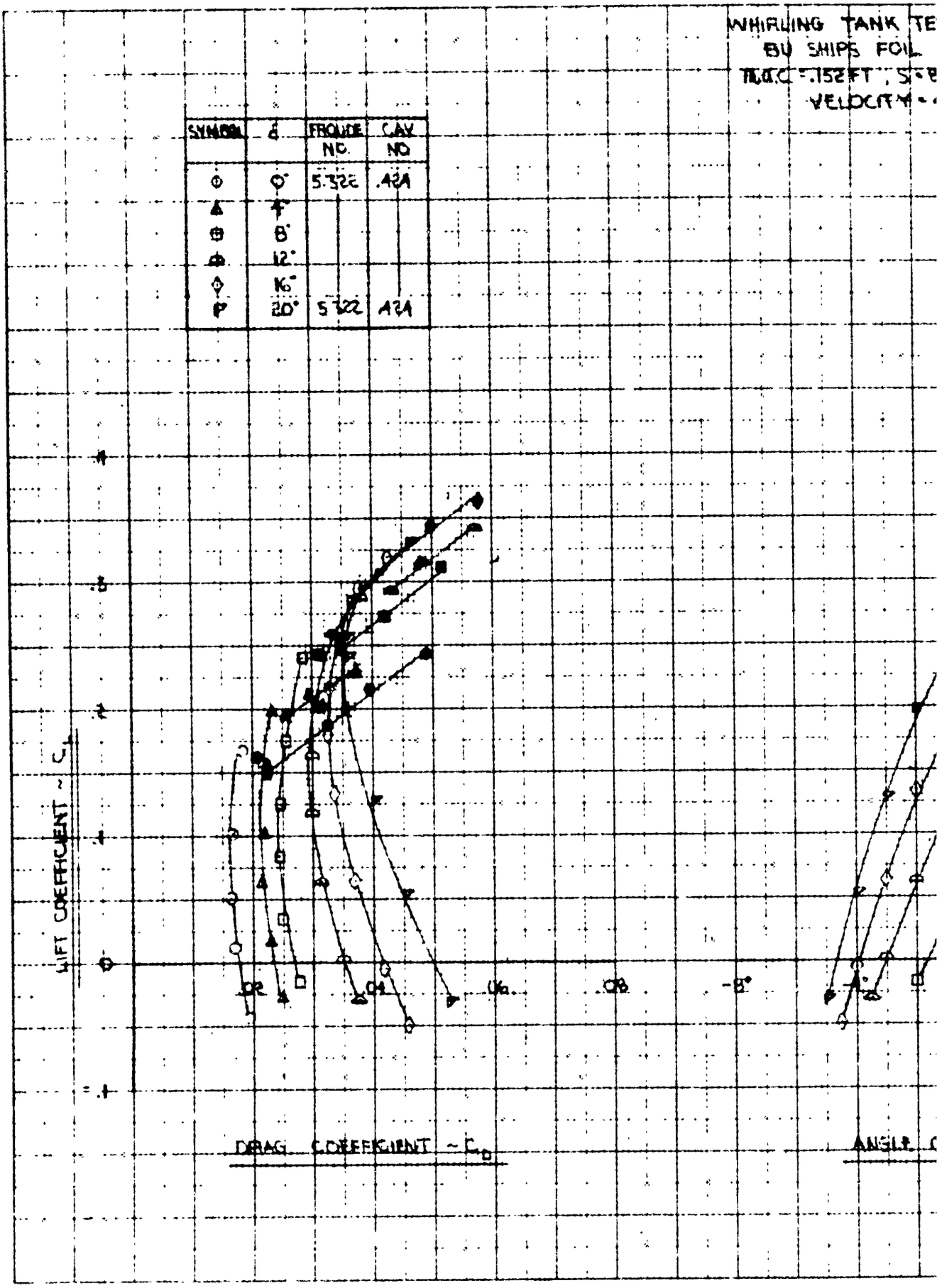
PITCHING MOMENT COEFF. ~ $C_{M_{c/4}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV. NO.
0°
4°
8°
12°
16°
20°
4 7 7 8 5
2 8 6 1
NOTE:
1 DAR
INDI
.4
.3
.2
.1
0
-.1
LIFT COEFF ~ C_L
.02
.04
.06
.08
-8°
-4°
DRAG COEFF ~ C_D
ANGL


PAGE IV.121
WHIRLING TANK TEST NO. 42
BUSHIPS FOIL NO. 13
M.A.C. = .152 FT AREA = 8□" d/c = 125
VEL. = 40 KTS
ARKENED SYMBOLS
NDICATE VENTED FLOW.
4°
8°
12°
-2
-4
GLE OF ATTACK ~ DEGREES
PITCHING MOMENT
COEFF. ~ $C_{M_{c/4}}$

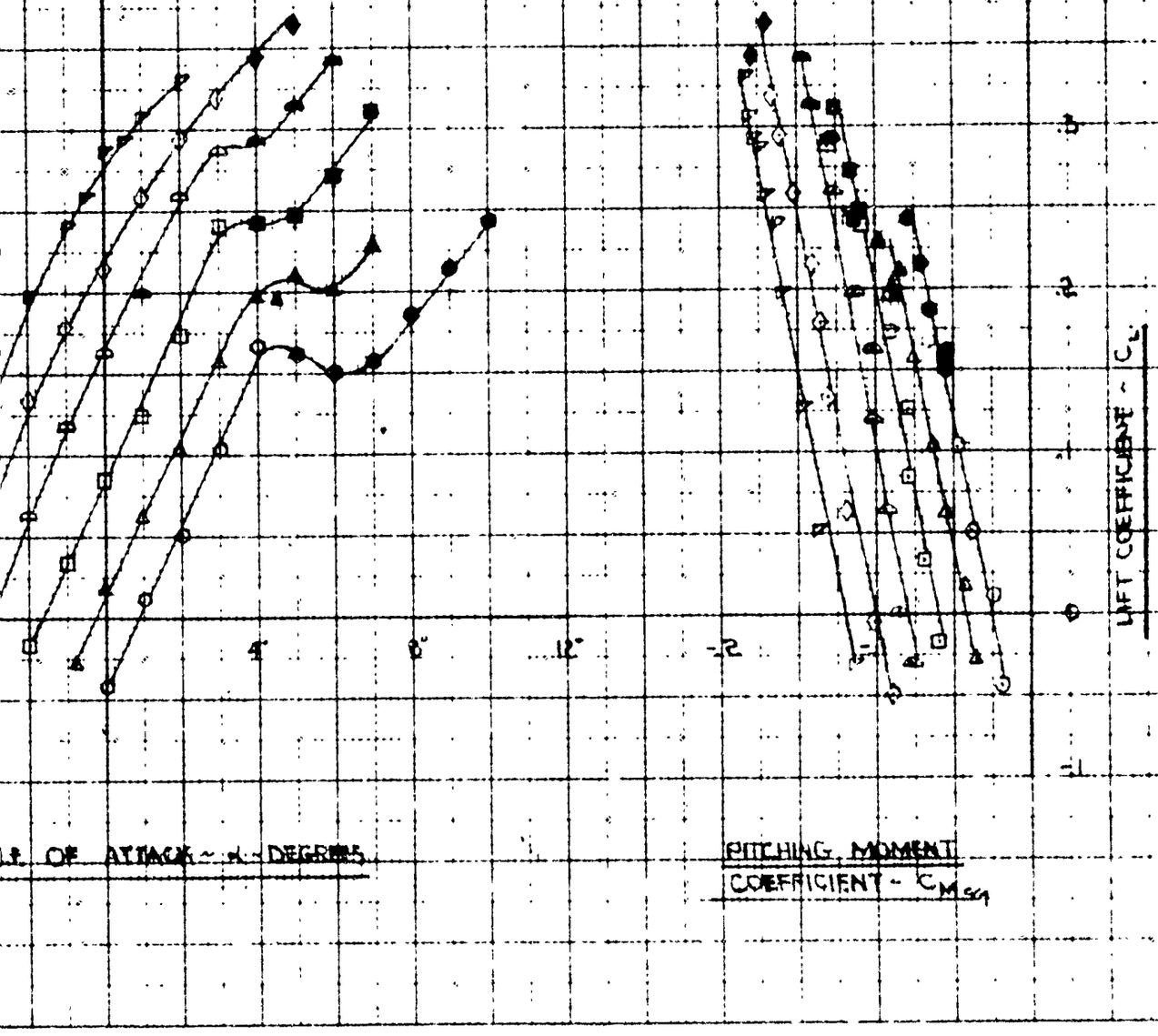

WHIRLING TA
BU SHIPS F
VELOC
SYMBOL
δ
FROUDE NO.
CAV NO.
0°
4°
8°
12°
16°
20°
6.123
.404
LIFT COEFFICIENT ~ C_L
DRAG COEFFICIENT ~ C_D
ANGL


TANK TEST NO 42
S FOIL NO 13
FT ; S = 8.00 SQ IN ; d/c = .75
LOCITY = 45 KTS
PAGE IV.122
NOTE DARKENED POINTS INDICATE VENTED FLOW
4°
8°
12°
-.2
+.4
+.3
+.2
+.1
0
-.1
LIFT COEFFICIENT ~ C_L
ANGLE OF ATTACK ~ α ~ DEGREES
PITCHING MOMENT
COEFFICIENT ~ $C_{M_{c/4}}$


WHIRLING TANK TE
BU SHIPS FOIL
VELOCITY =
SYMBOL
α
FROUDE NO.
CAV NO
0°
4°
8°
12°
16°
20°
5.322
.424
5.322
.424
LIFT COEFFICIENT ~ C_L
.02
.04
.06
.08
-8°
DRAG COEFFICIENT ~ C_D
ANGLE

TEST NO 42
OIL NO 13
S = 8.00 SQ IN; C/C = 1.00
M = 45 KTS

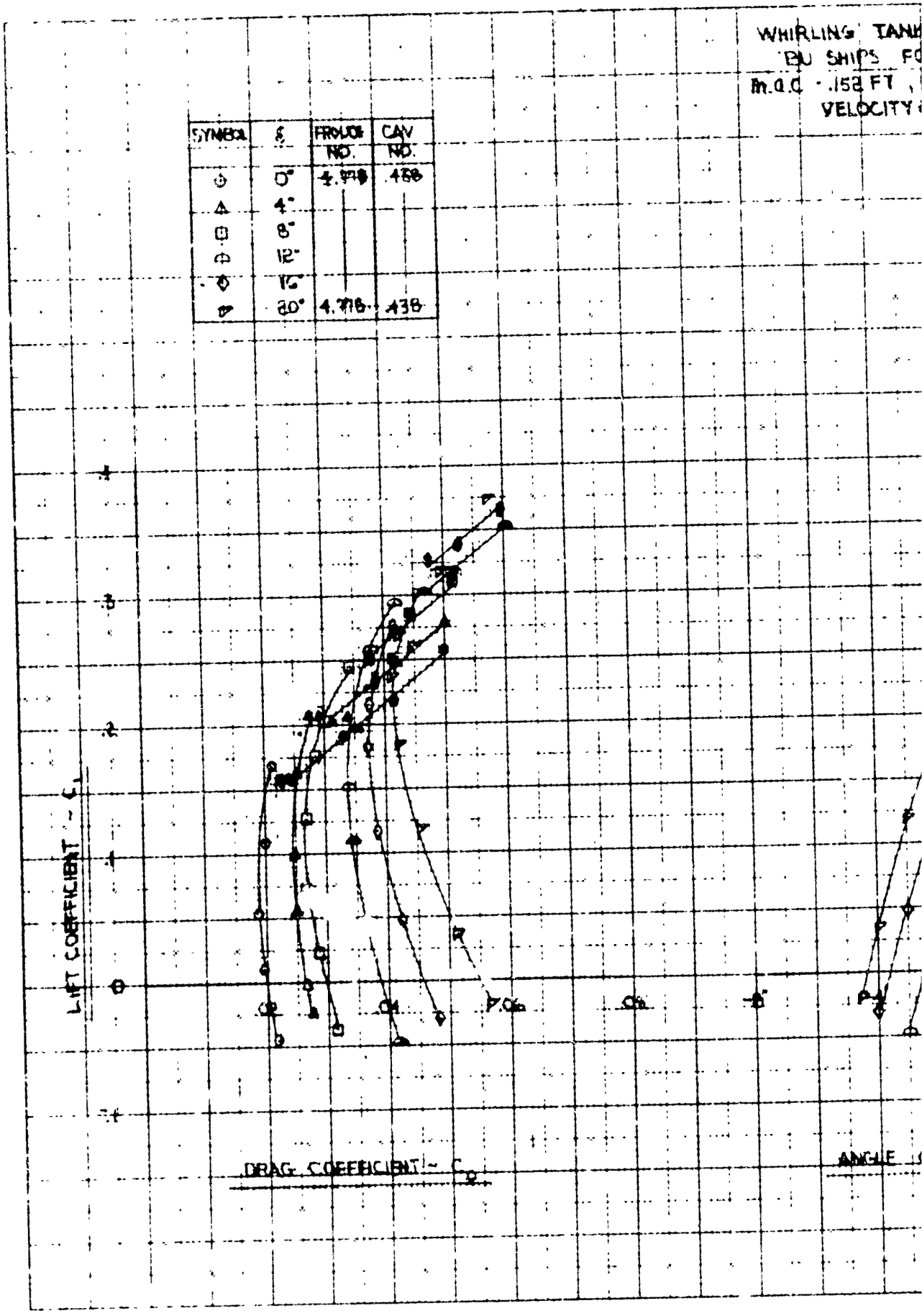
NOTE: DARKENED POINTS INDICATE VENTED FLOW



LIFT COEFFICIENT - C_L

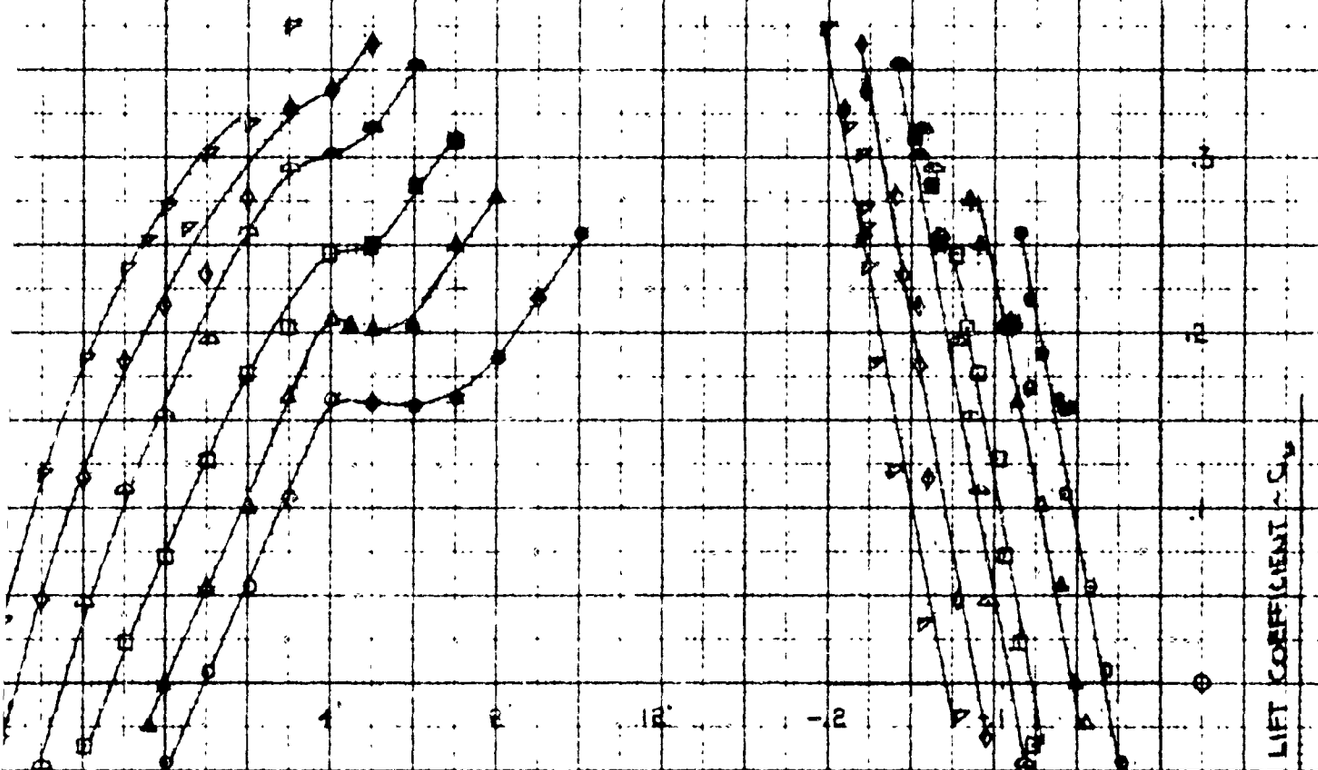
ANGLE OF ATTACK - α - DEGREES

PITCHING MOMENT COEFFICIENT - $C_{M_{c/4}}$


WHIRLING TANK
BU SHIPS FO
m.a.c. - .152 FT
VELOCITY
SYMBOL
δ
FROUDE NO.
CAV NO.
0°
4°
8°
12°
16°
20°
4.716
.438
LIFT COEFFICIENT - C_L
DRAG COEFFICIENT - C_D
ANGLE

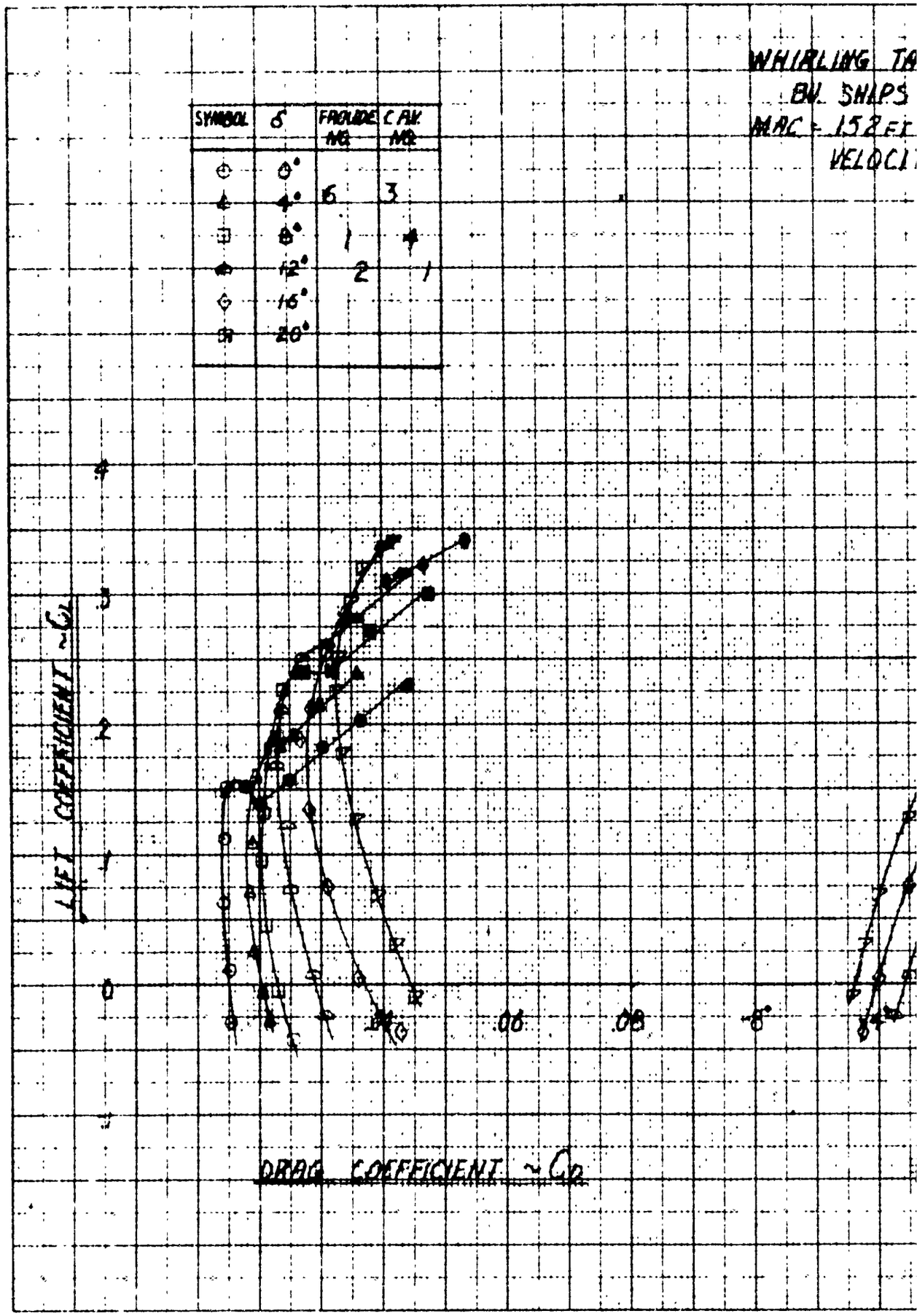
ANK TEST NO 42
FOIL NO 18
T , S = 8.00 SQ IN , d/c = 1.25
ITY = 45 KTS

NOTE: DARKENED POINTS INDICATE VENTED FLOW



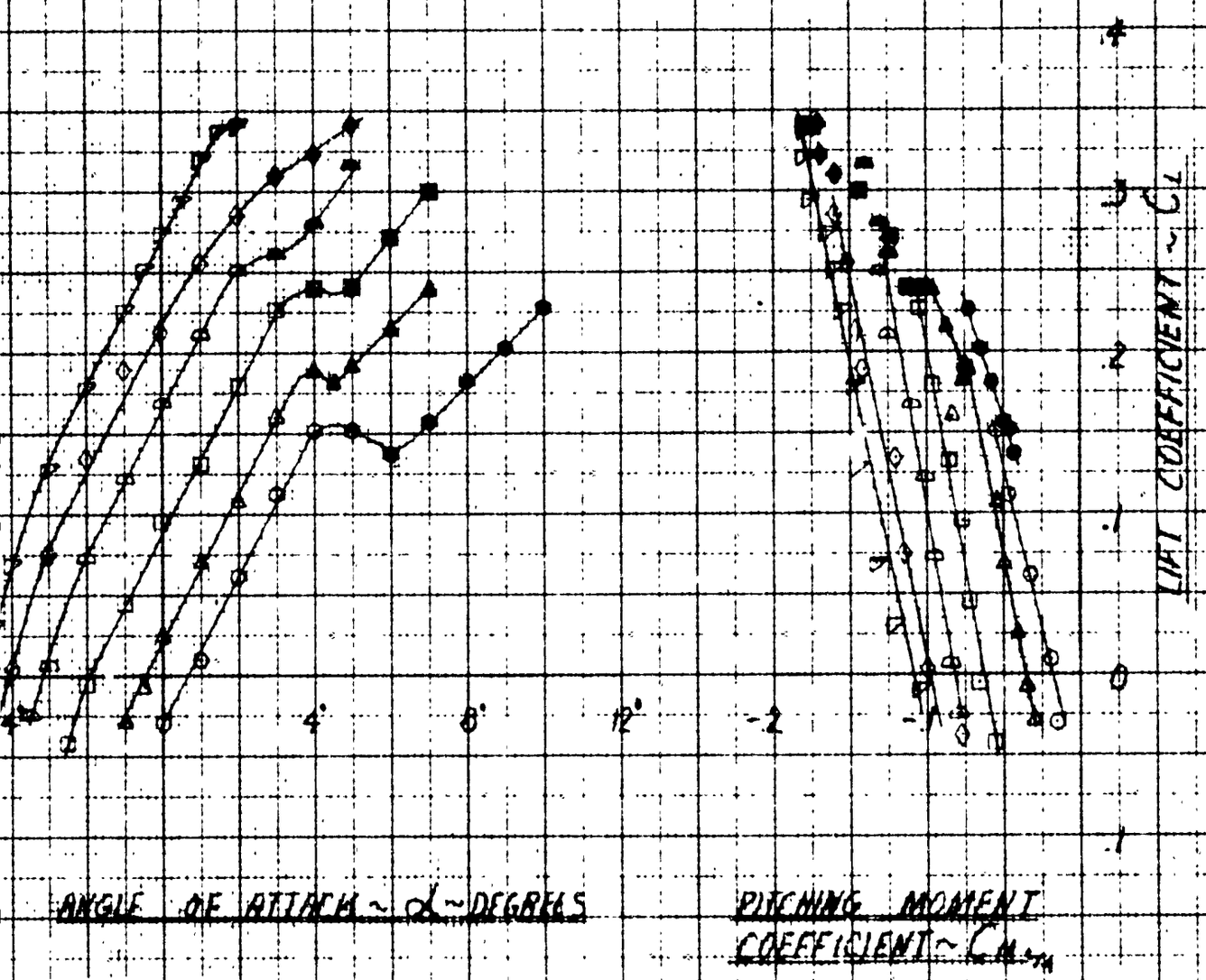
E OF ATTACK - α - DEGREES

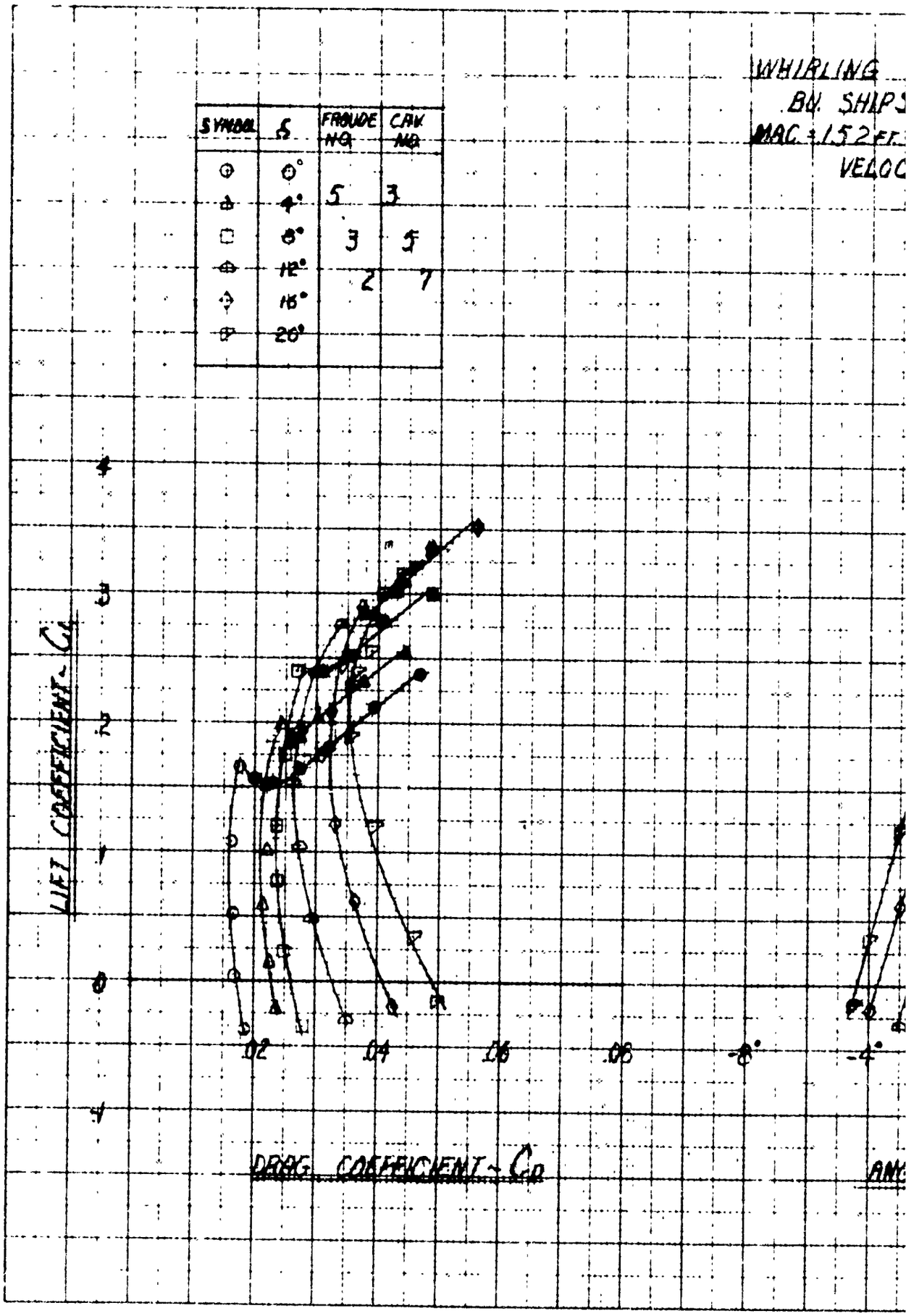
PITCHING MOMENT COEFFICIENT - $C_{m\ a/4}$


WHIRLING TA
BU. SHIPS
MAC - 152 FT
VELOCI
SYMBOL
δ
FROUDE NO.
CAV. NO.
0°
4°
8°
12°
16°
20°
6
3
1
4
2
1
LIFT COEFFICIENT ~ C_L
4
2
0
.06
.08
-8°
DRAG COEFFICIENT ~ C_D

TANK TEST NO. 42
APS FOIL NO. 13
FT ; S = 8.00 IN² ; α/c = .75
OCITY = 50 KTS.

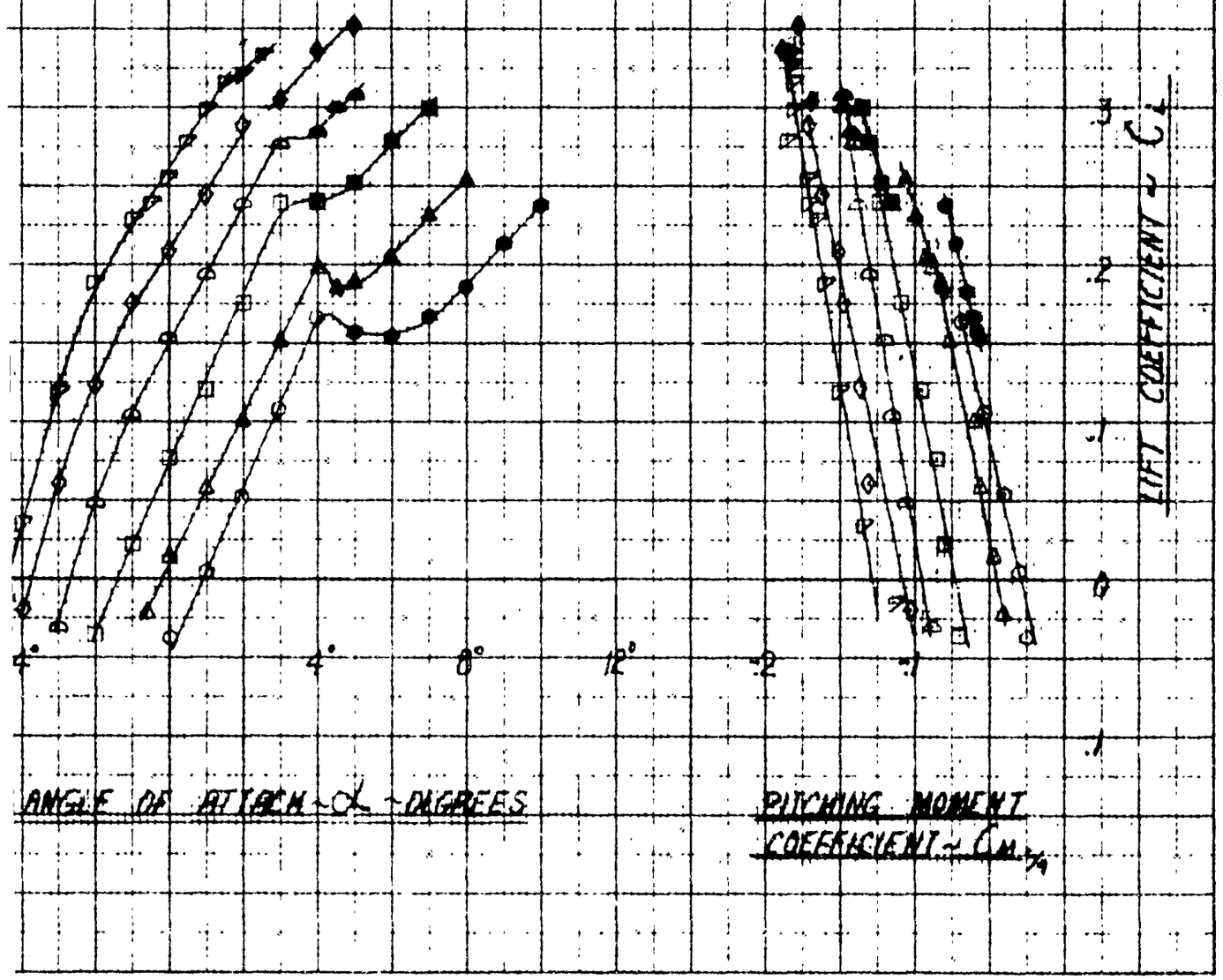
NOTE: DARKENED SYMBOLS INDICATE VENTED FLOW.

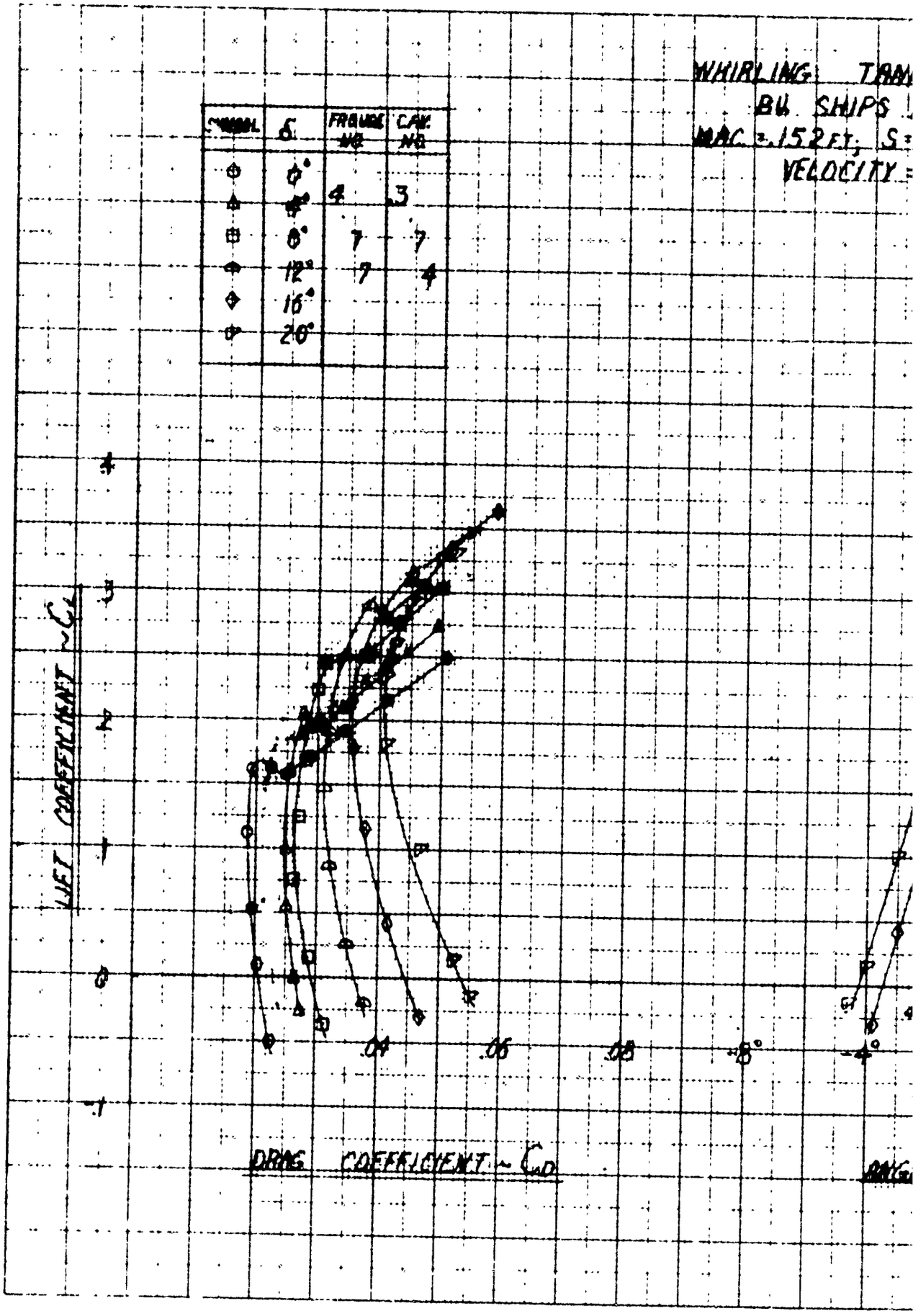



WHIRLING
BU. SHIPS
MAC = 1.52 FT.
VELOC
SYMBOL
δ
FROUDE NO
CAV NO
0°
4°
8°
12°
16°
20°
5
3
3
5
2
7
LIFT COEFFICIENT - CL
DRAG COEFFICIENT - CD
.02
.04
.06
-8°
-4°
AN

G TANK TEST NO. 42
HIPS FOIL NO. 13
EF.; S = 8.00 IN² ; d/c = 1.00
LOCITY = 50 KTS.

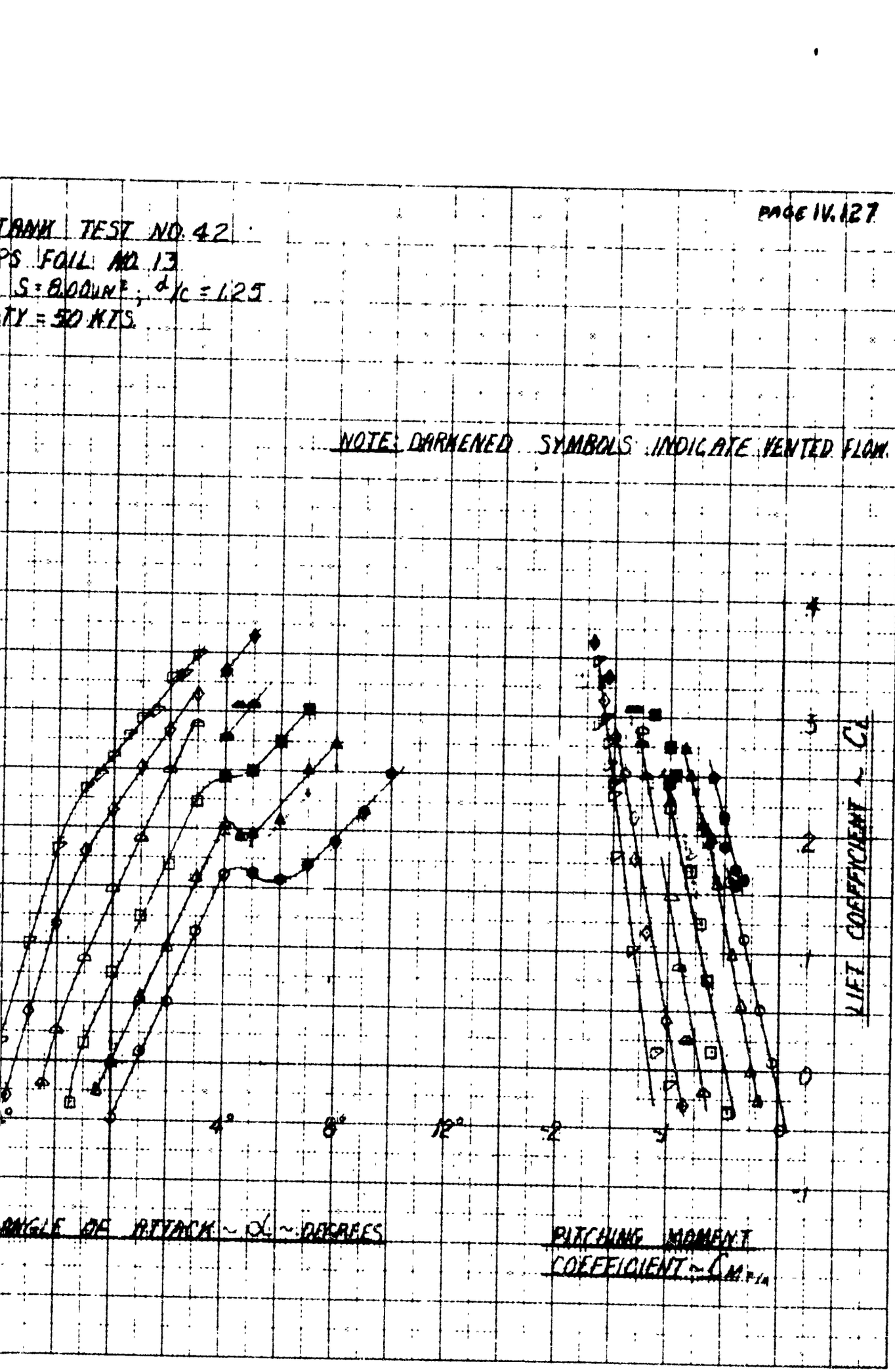
NOTE: DARKENED SYMBOLS INDICATE VENTED FLOW.

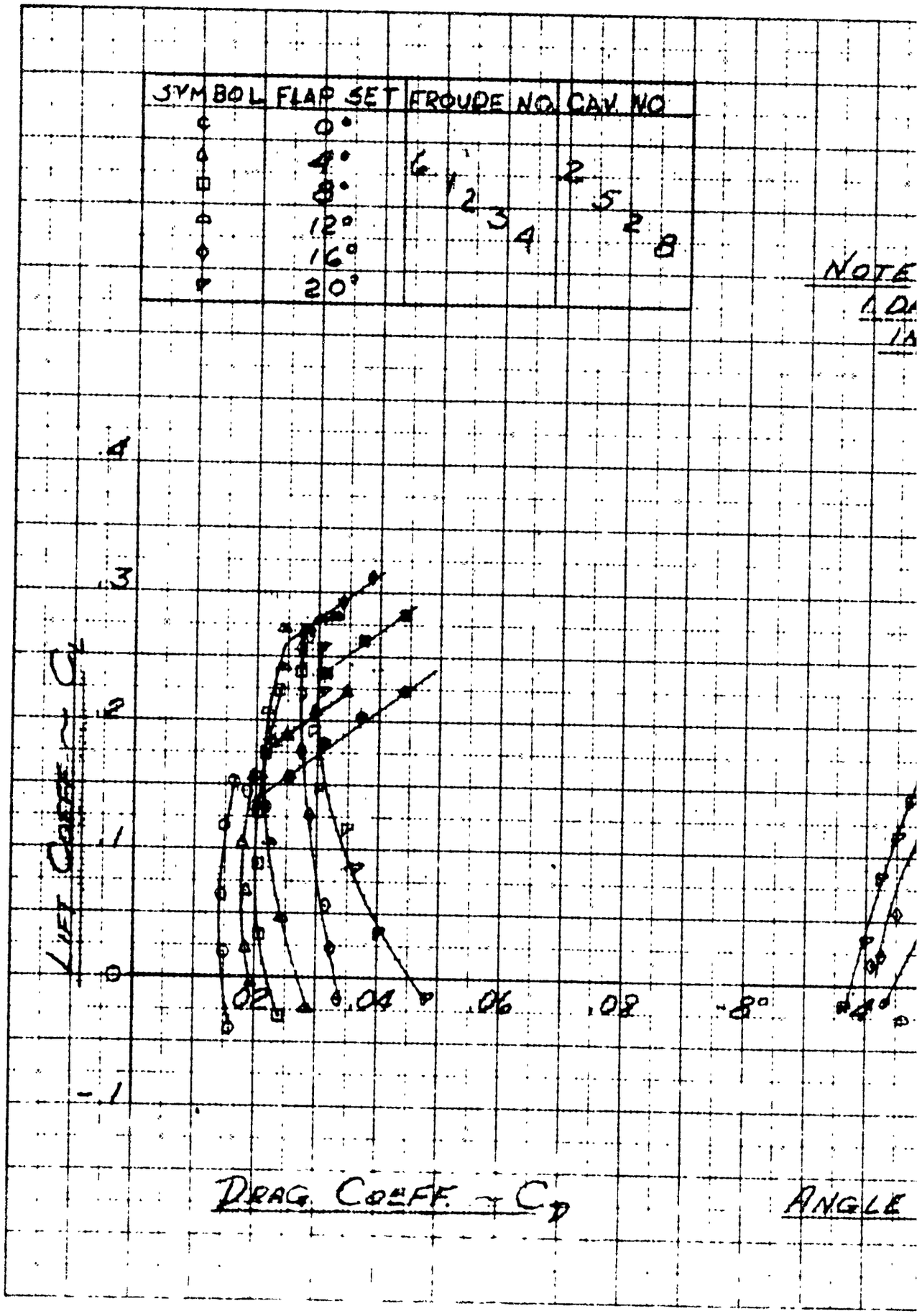



WHIRLING TAN
BU SHIPS
MAC = 1.52 FT, S =
VELOCITY =
SYMBOL
δ
FIGURE NO
CAV. NO
0°
4°
8°
12°
16°
20°
4
3
7
7
7
4
LIFT COEFFICIENT ~ C_L
DRAG COEFFICIENT ~ C_D
.04
.06
.08
-8°
-4°

TANK TEST NO. 42
PS FOIL NO. 13
S = 8.00 UNIT²; d/c = 1.25
TY = 50 KTS.

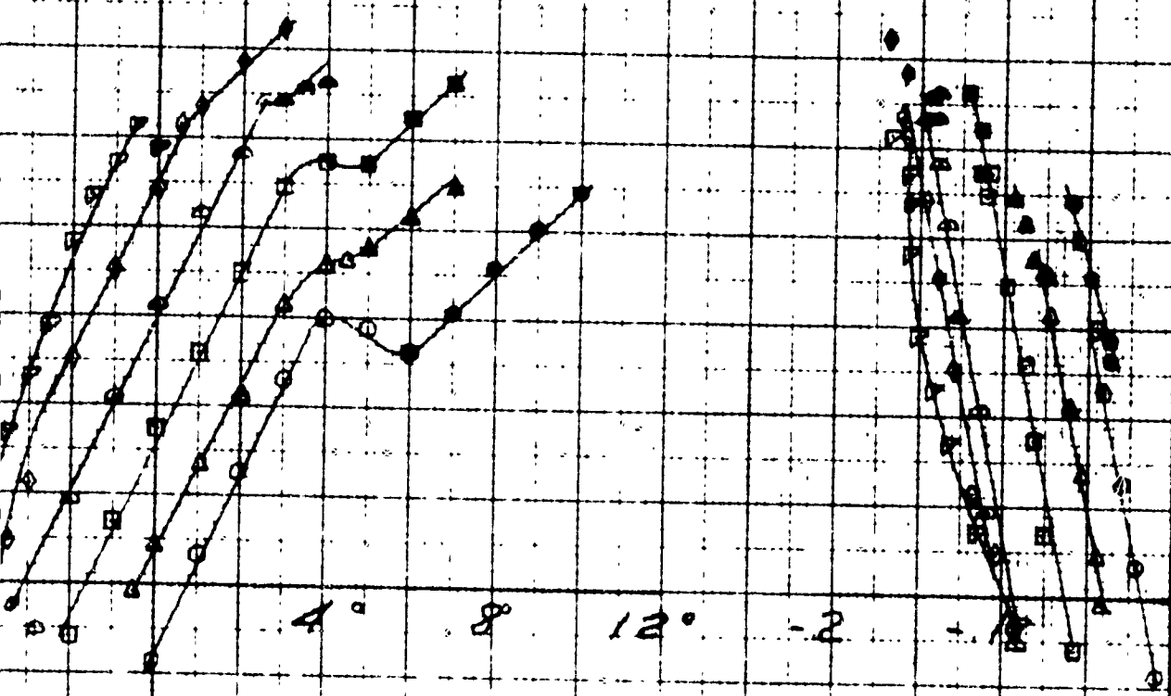
NOTE: DARKENED SYMBOLS INDICATE VENTED FLOW.




SYMBOL
FLAP SET
FROUDE NO.
CAV. NO
0°
4°
8°
12°
16°
20°
6
1
2
3
4
2
5
2
8
NOTE
.4
.3
.2
.1
0
-.1
LIFT COEFF. - C_L
.02
.04
.06
.08
-8°
DRAG COEFF. - C_D
ANGLE

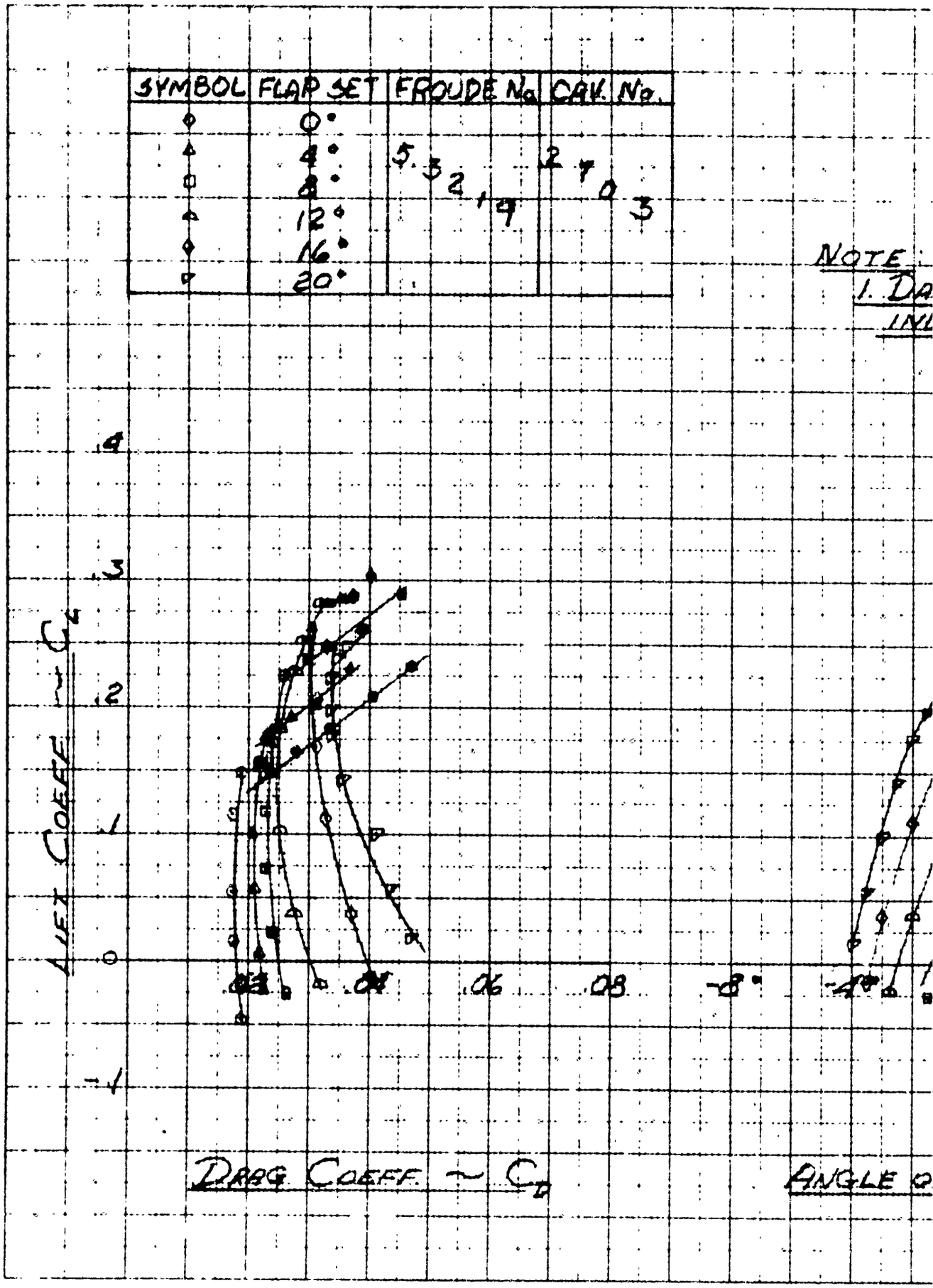
WHIRLING TANK TEST NO 42
BUSHIPS FOIL NO 13
MAC = 1.52 FT AREA = 80" ℓ/c = 7.5
VEL = 60 KTS

TE
DARKENED SYMBOLS
INDICATE VIATED FLOW



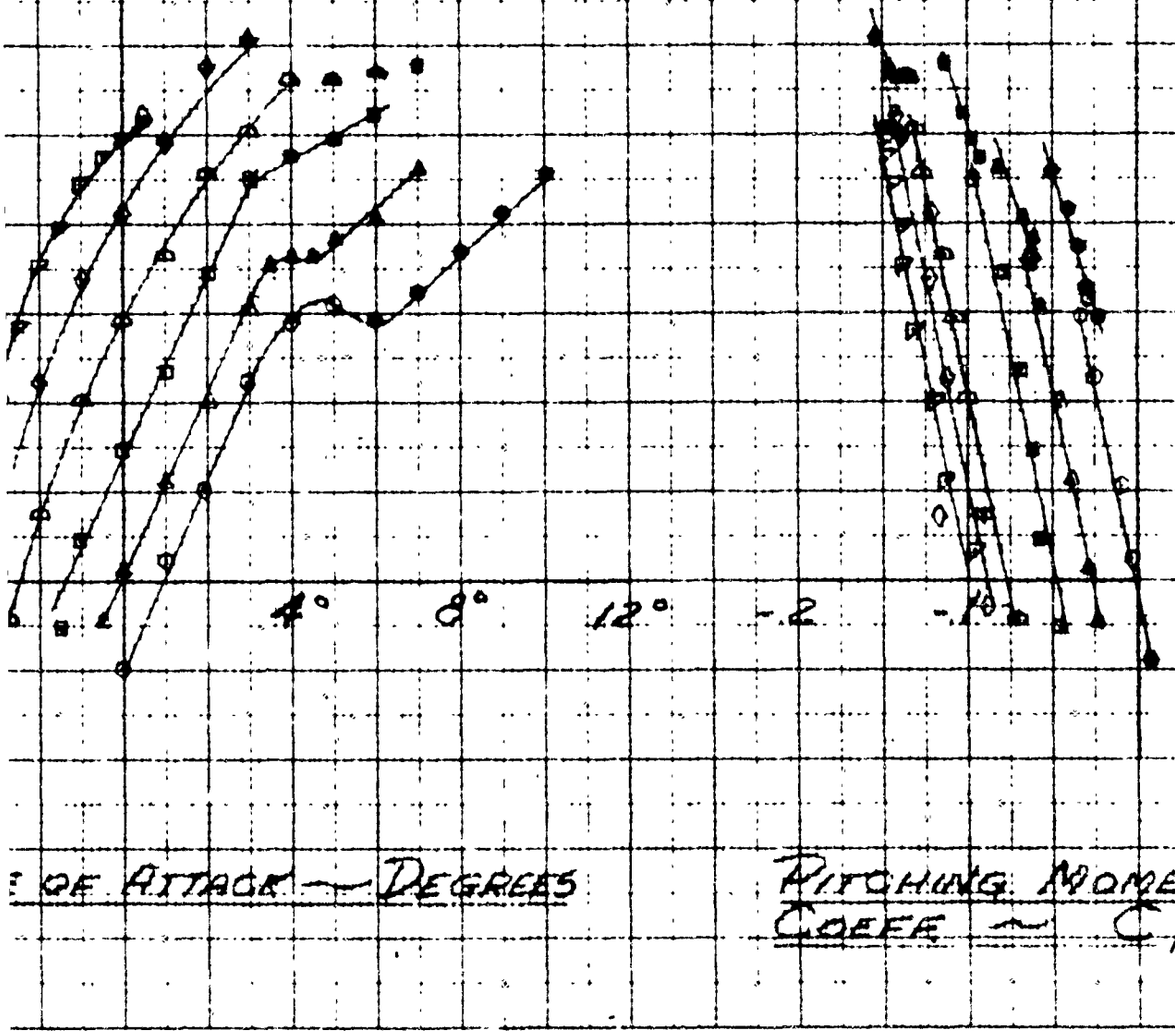
E OF ATTACK ~ DEGREES

PITCHING MOMENT
COEFF ~ $C_{M_{c/4}}$


SYMBOL
FLAP SET
FROUDE No.
CAV. No.
0°
4°
8°
12°
16°
20°
5.3
2.9
2.7
0.3
NOTE
1. Da
IN
.4
.3
.2
.1
0
-.1
LIFT COEFF ~ C_L
.02
.04
.06
.08
-8°
-4°
DRAG COEFF ~ C_D
ANGLE O

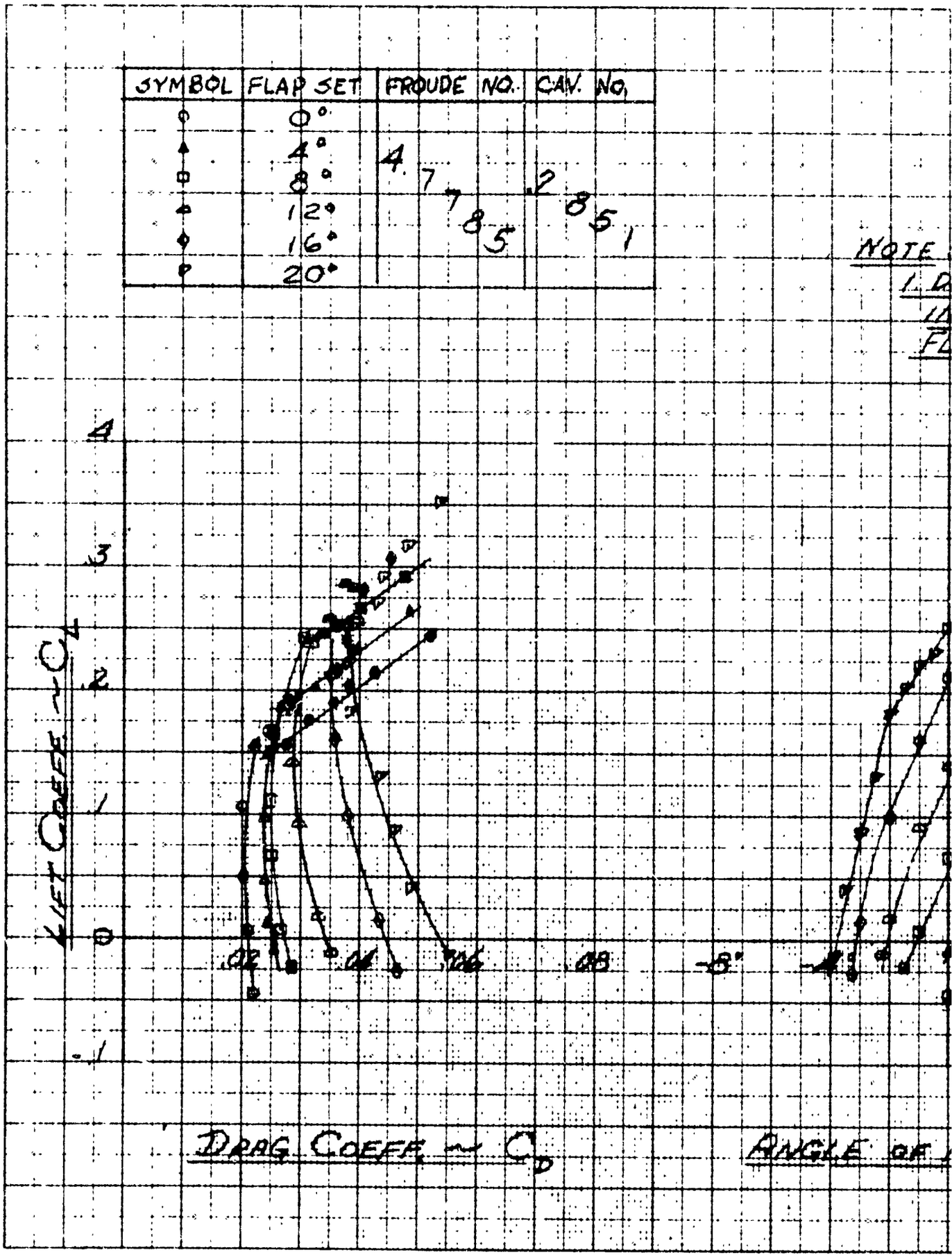
WHIRLING TANK TEST NO. 42
BUSHIPS FOIL NO. 13
M.A.C. = 1.52 FT. AREA = 8.0 FT² d/c 1.00
VEL = 60 KTS

DARKENED SYMBOLS
INDICATE VENTED FLOW



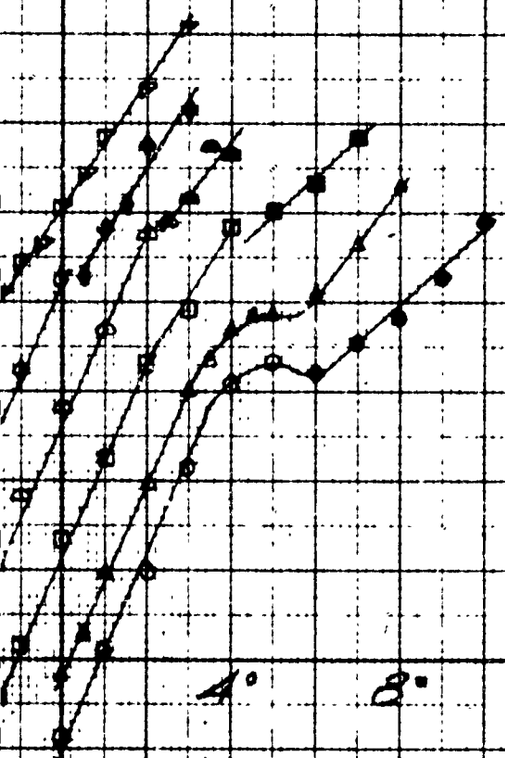
OF ATTACK — DEGREES

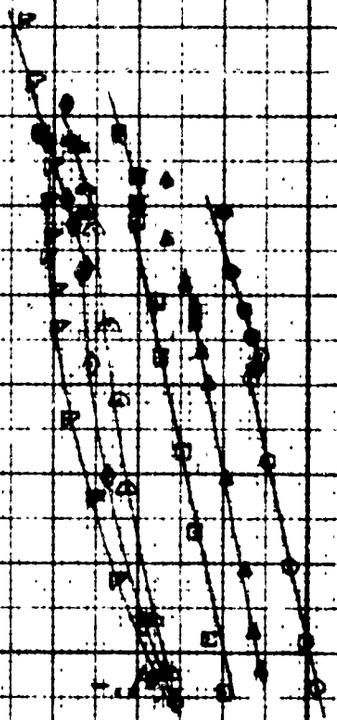
PITCHING MOMENT
COEFF — $C_{M_{C/4}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV. NO.
0°
4°
8°
12°
16°
20°
4.7
7
8
5
.2
8
5
1
NOTE
LIFT COEFF ~ C_L
4
3
.2
.1
0
-.1
.02
.04
.06
.08
-8°
DRAG COEFF ~ C_D
ANGLE OF

WHIRLING TANK TEST NO. 462
BUSHIAS FOIL NO. 13
M.A.C. = .152 FT AREA = 8 P" d/c = 1.25
VEL. = 60 KTS

TE
DARKENED SYMBOLS
INDICATE VENTED
FLOW

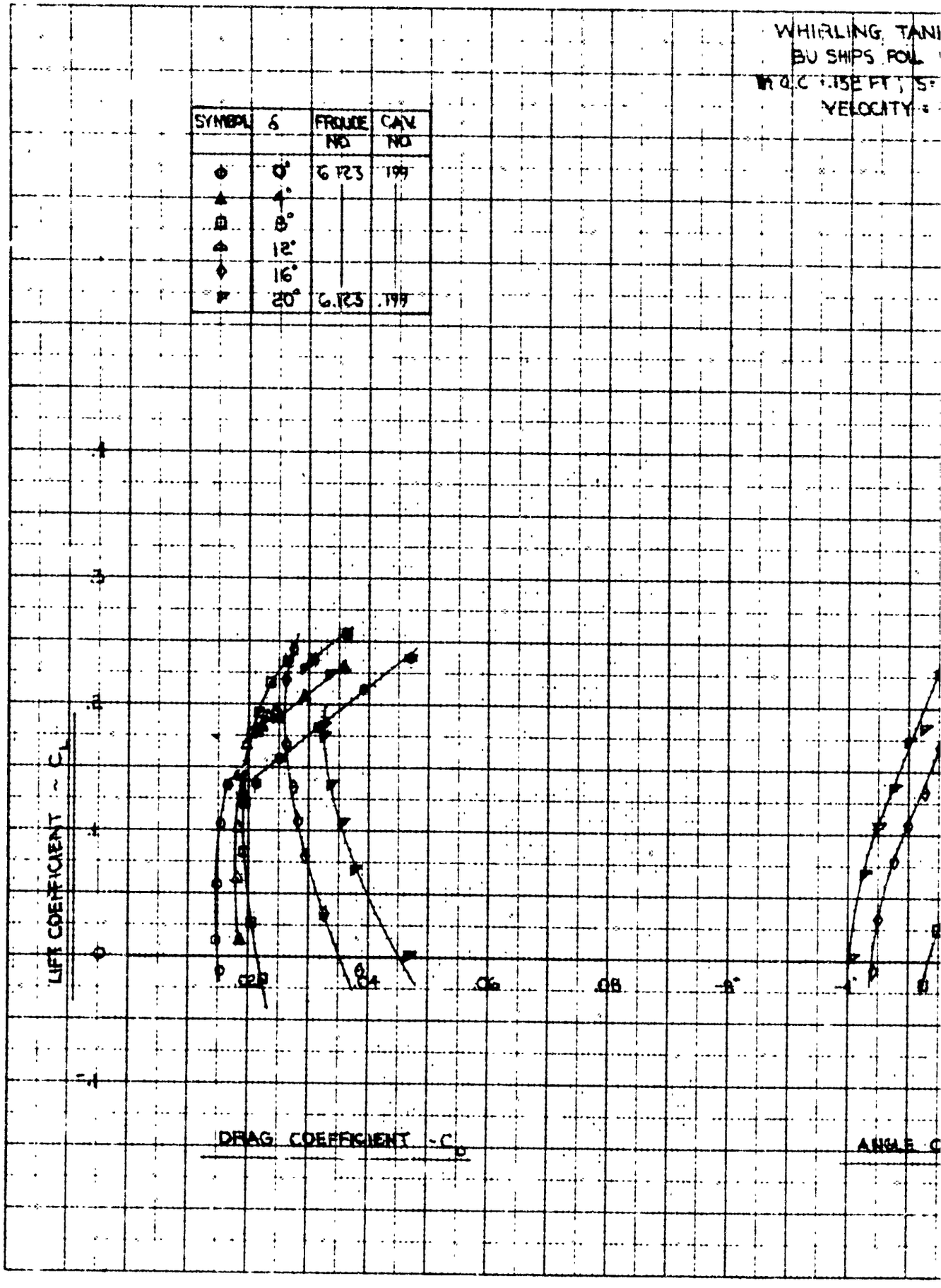




4° 8° 12° -.2 -.4

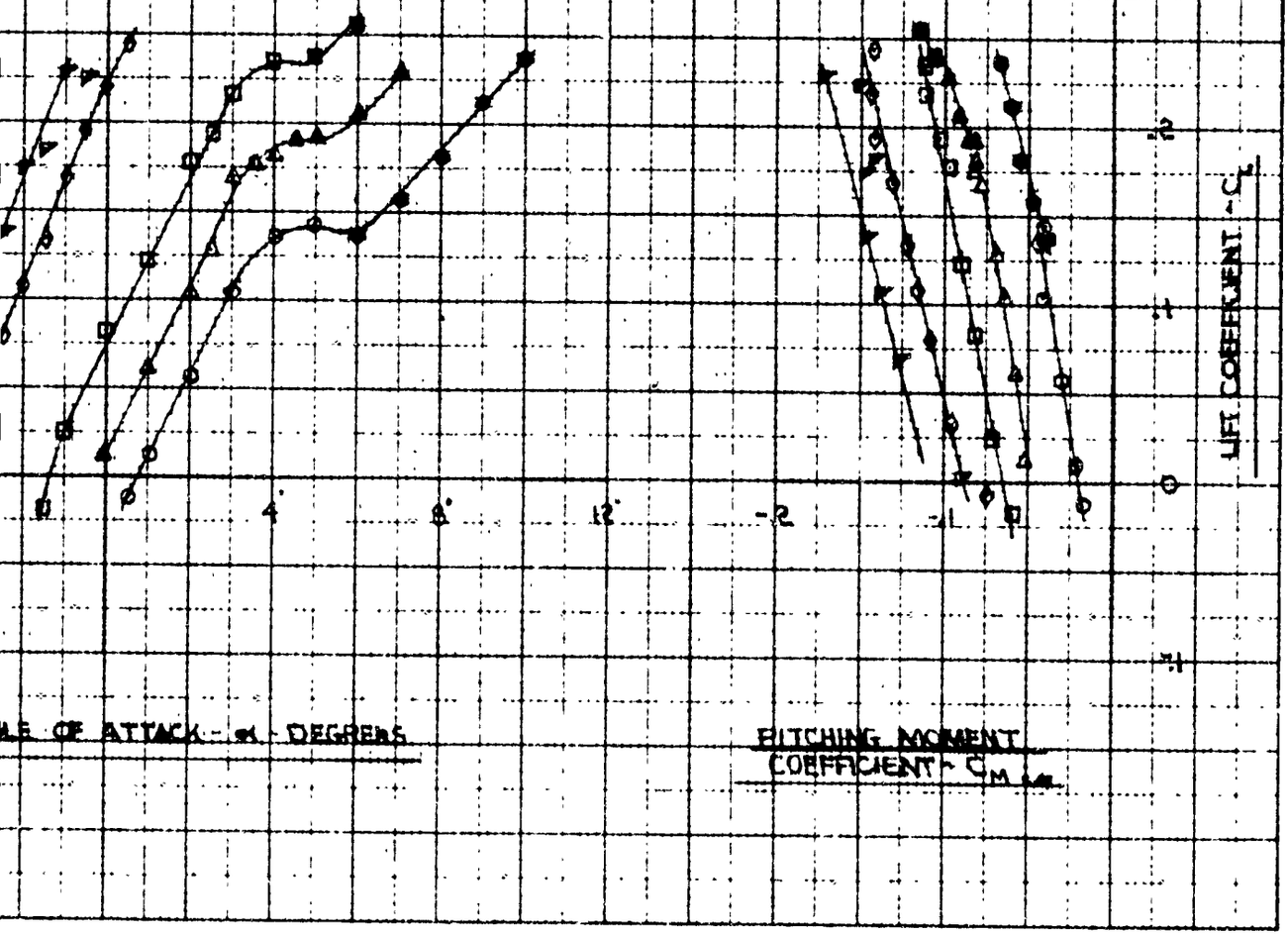
ATTACK — DEGREES

PITCHING MOMENT
COEF — $C_{M_{c/4}}$


WHIRLING TANK
BU SHIPS FOIL
W Q.C .15E FT, S=
VELOCITY =
SYMBOL | δ | FROUDE NO. | CAV. NO.
0° | 6.123 | .199
4°
8°
12°
16°
20° | 6.123 | .199
LIFT COEFFICIENT ~ C_L
DRAG COEFFICIENT ~ C_D
.02
.04
.06
.08
-8°
ANGLE

TANK TEST NO 42
FOIL NO 13
T.S. 800 SQ IN A/C - .75
TY = 90 KTS

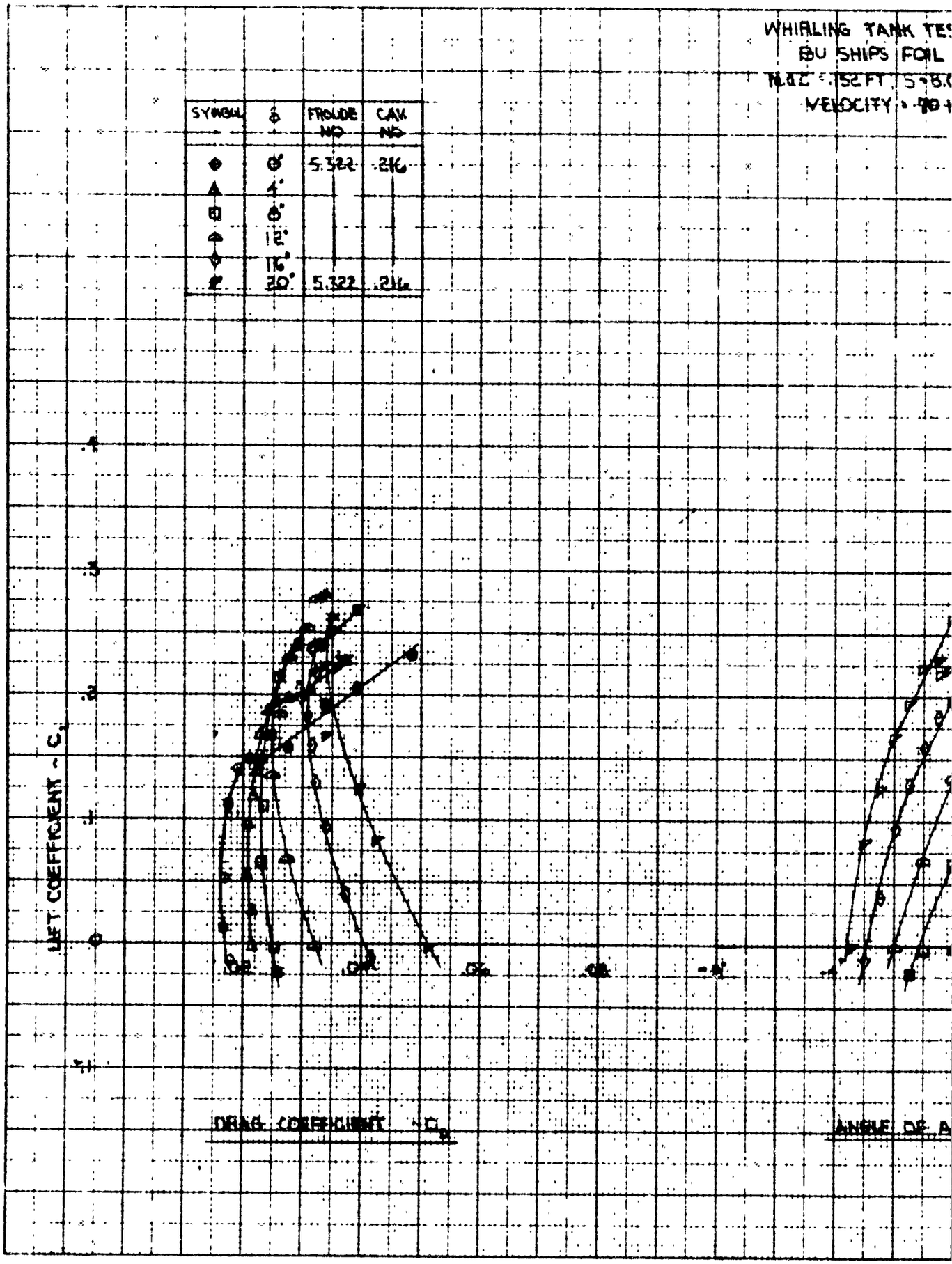
NOTE: DARKENED POINTS INDICATE VENTED FLOW

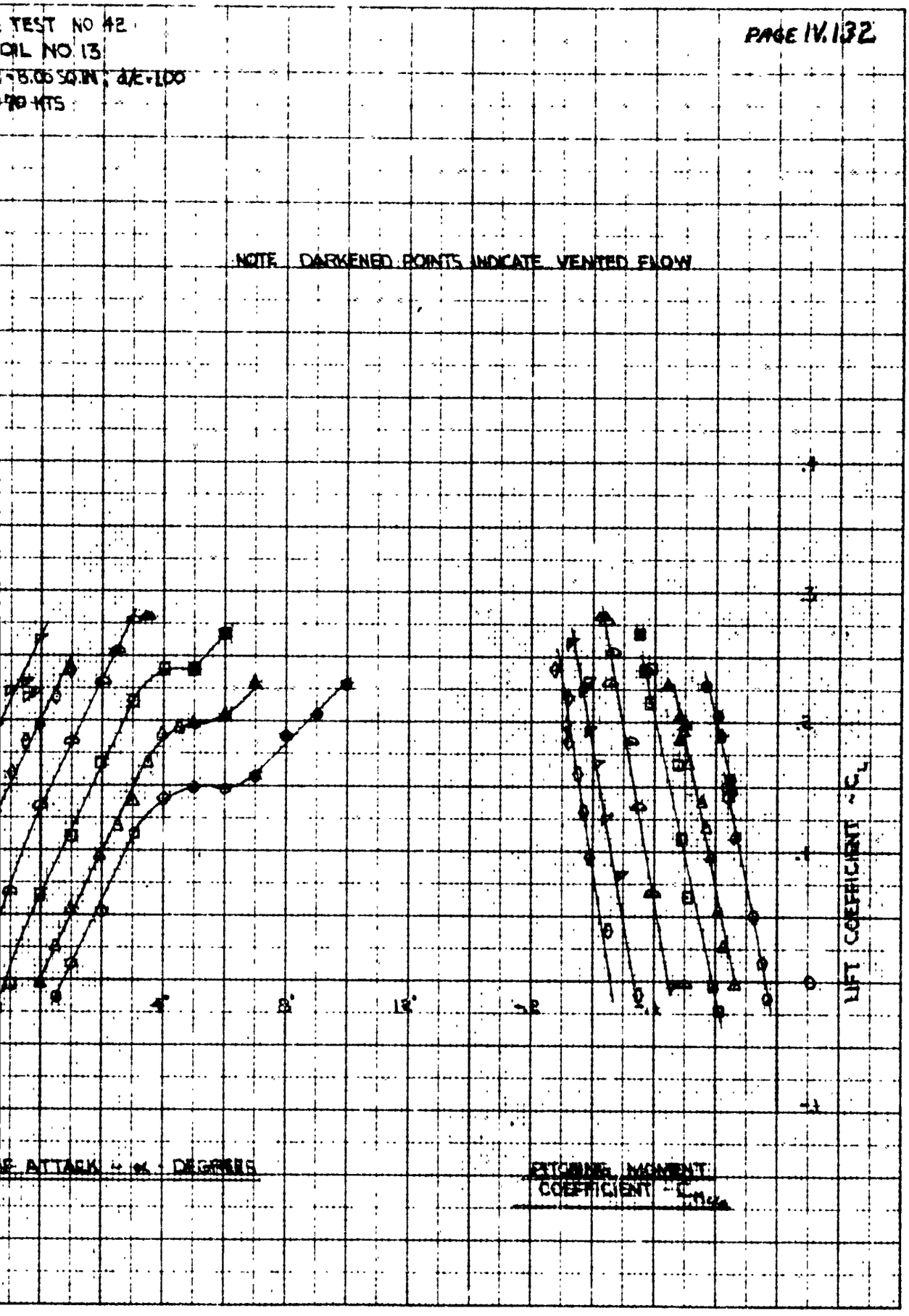


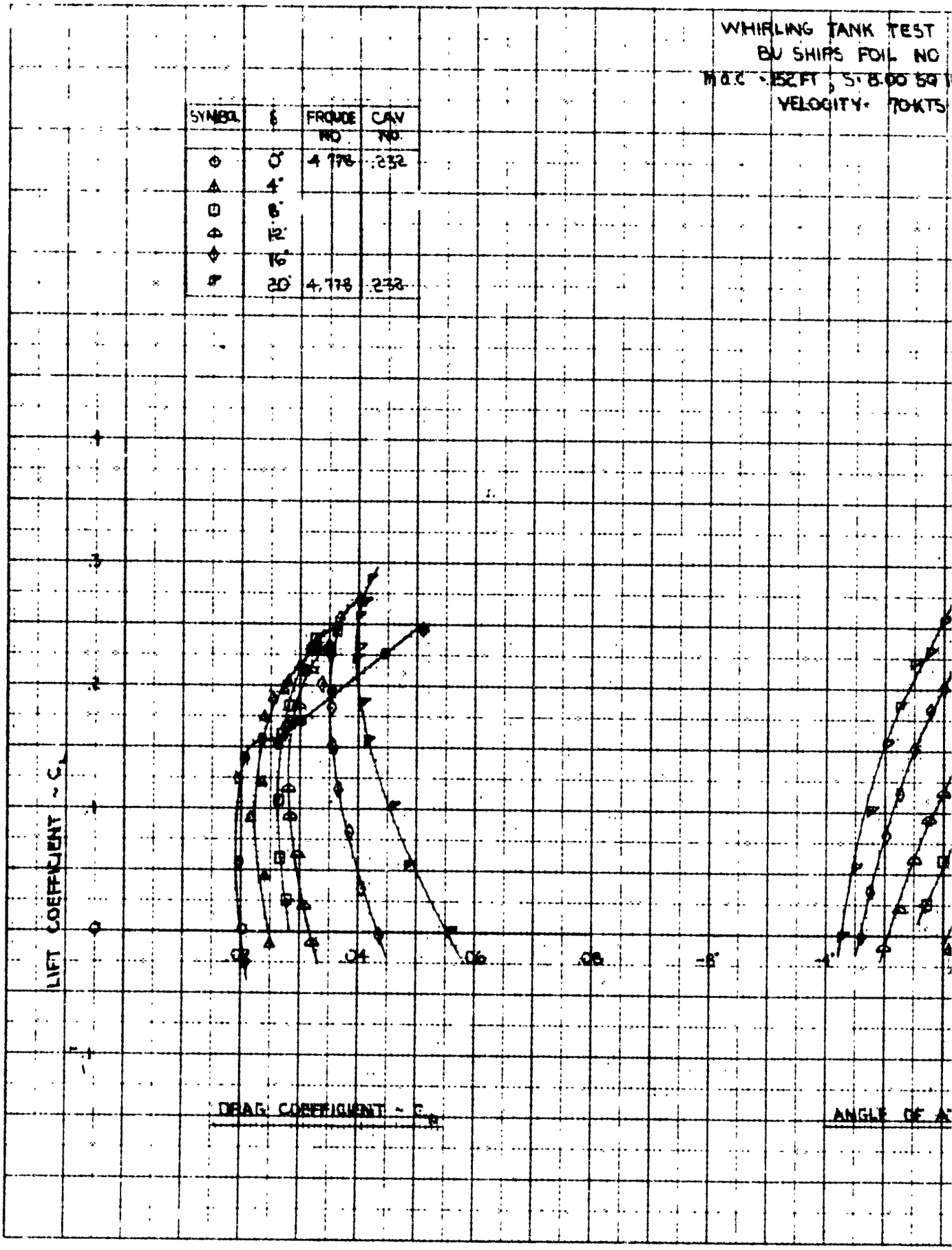
LIFT COEFFICIENT - C_L

LE OF ATTACK - α - DEGREES

PITCHING MOMENT COEFFICIENT - $C_{M_{1/4}}$

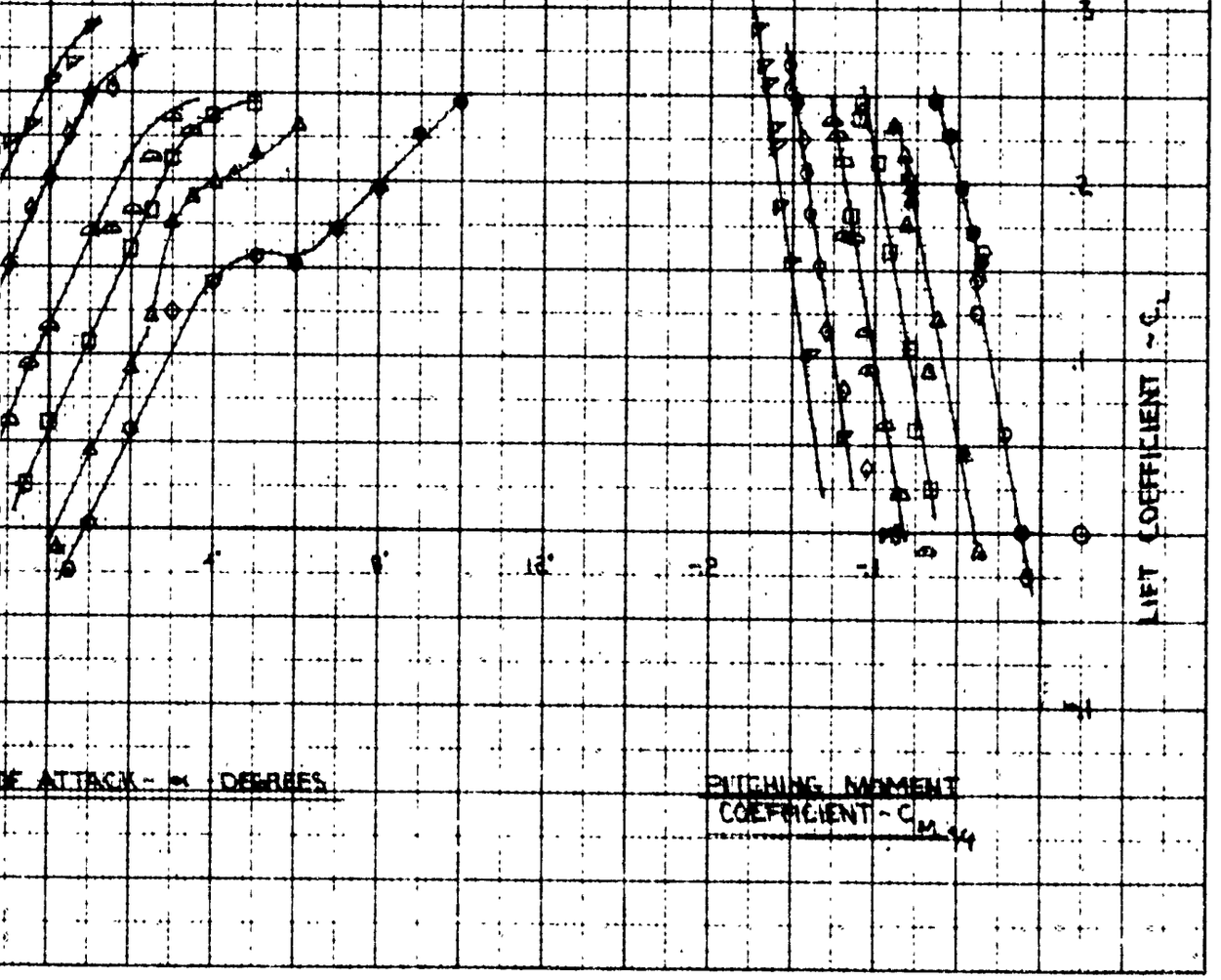

WHIRLING TANK TES
BU SHIPS FOIL
SYMBOL
FROUDE NO
CAV NO
5.322
.216
5.322
.216
LIFT COEFFICIENT ~ C_L
DRAG COEFFICIENT ~ C_D
ANGLE OF A


TEST NO 42
OIL NO 13
-8.06 SQ.IN ; d/c=1.00
70 KTS
PAGE IV.132
NOTE DARKENED POINTS INDICATE VENTED FLOW
4°
8°
12°
-2
.4
.3
.2
.1
0
-.1
LIFT COEFFICIENT - C_L
ATTACK - α - DEGREES
PITCHING MOMENT
COEFFICIENT - $C_{M_{c/4}}$


WHIRLING TANK TEST
BU SHIPS FOIL NO
M.A.C. = 1.52 FT, S = 8.00 SQ
VELOCITY = 70 KTS
SYMBOL
δ
FROUDE NO.
CAV NO.
0°
4°
8°
12°
16°
20°
4.778
.232
.232
LIFT COEFFICIENT - C_L
DRAG COEFFICIENT - C_D
ANGLE OF A
.02
.04
.06
.08
-8°
-4°

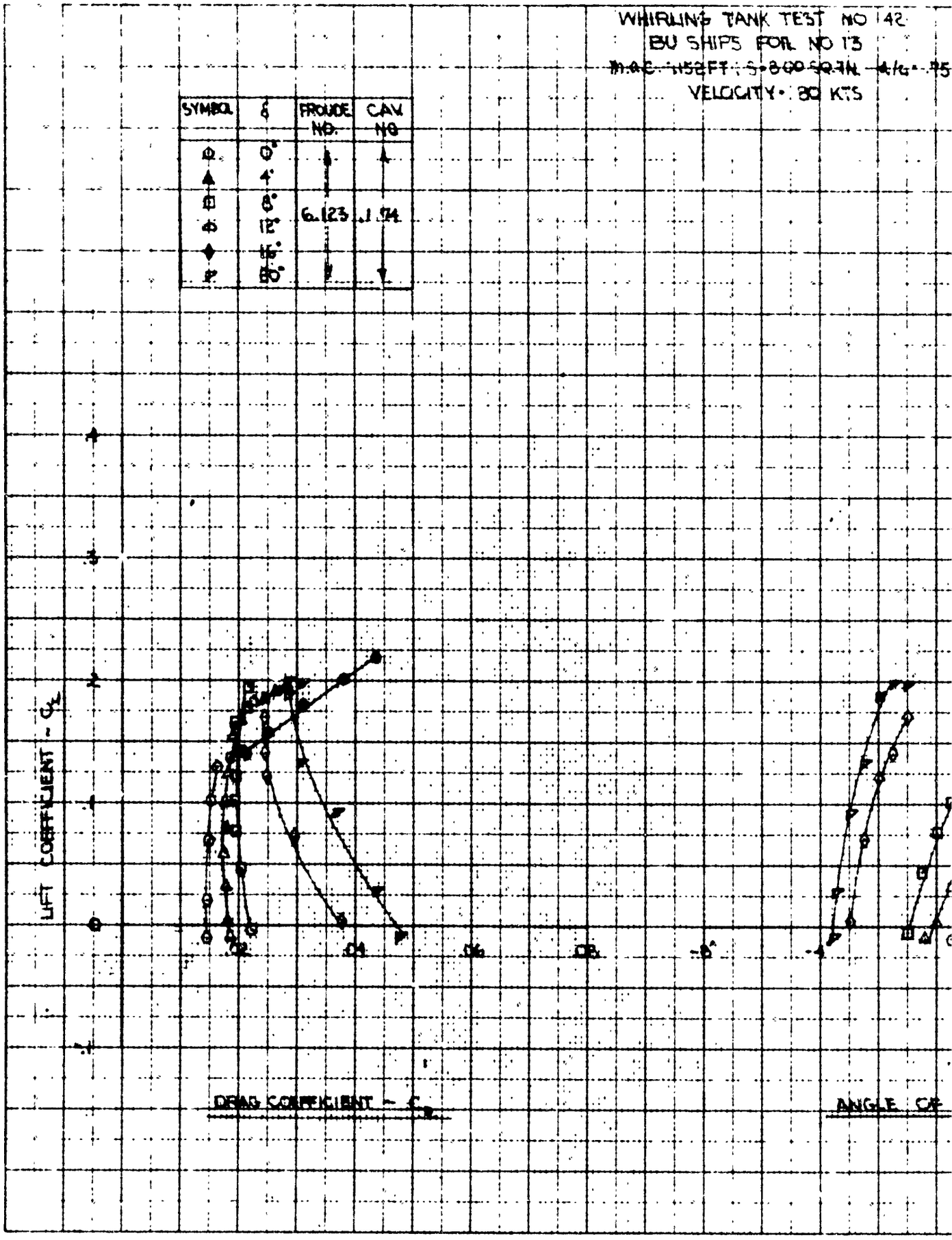
.ST NO 42
NO 13
SQ IN ; a/c = 1.25
KTS

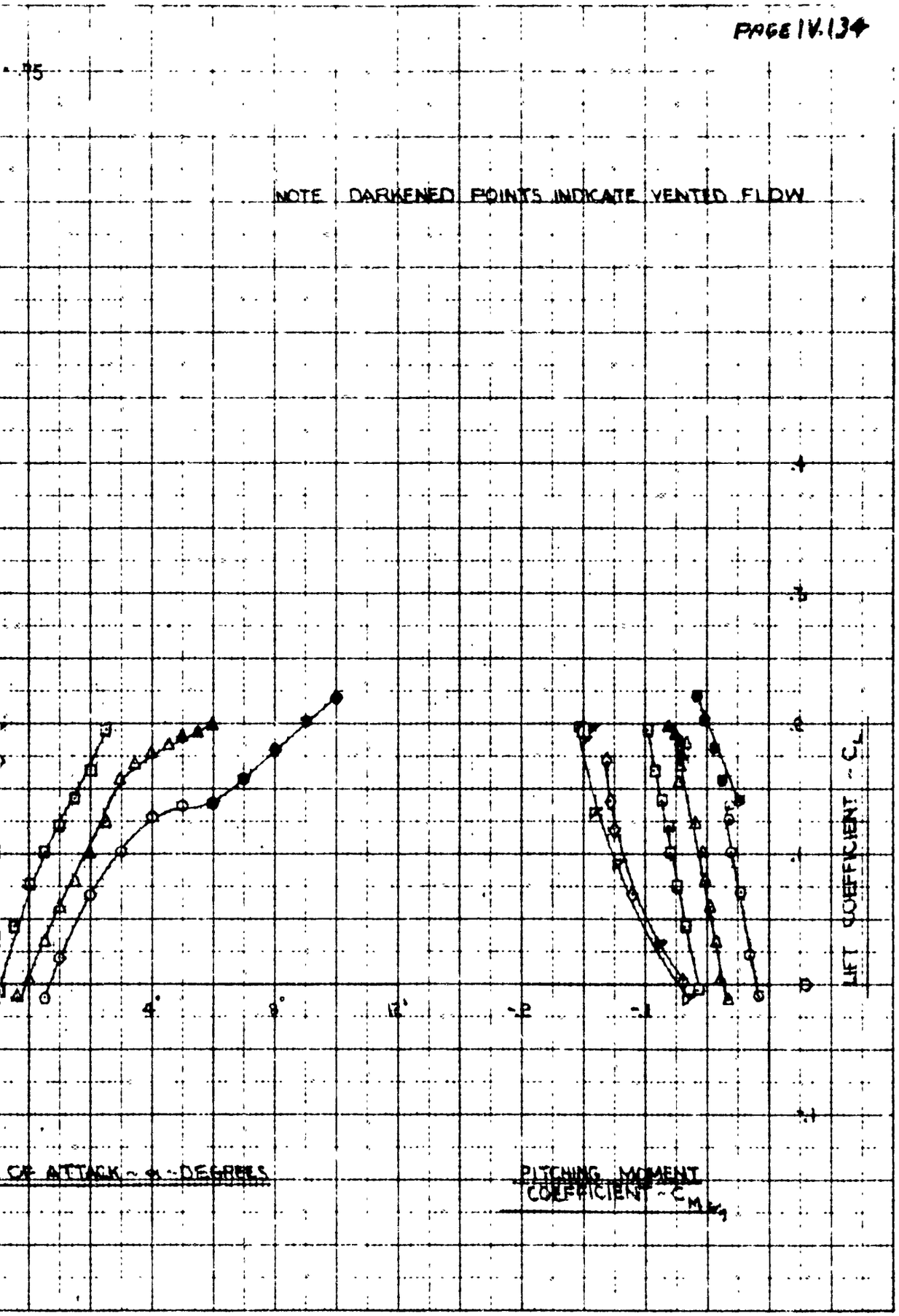
NOTE - DARKENED POINTS INDICATE VENTED FLOW



OF ATTACK - α - DEGREES

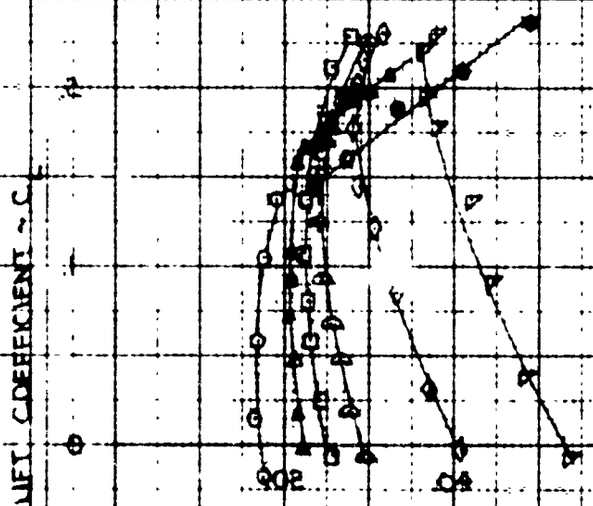
PITCHING MOMENT COEFFICIENT - $C_{M_{1/4}}$

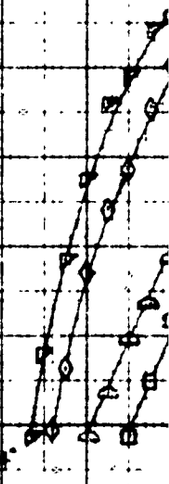

WHIRLING TANK TEST NO 42
BU SHIPS FOIL NO 13
VELOCITY = 80 KTS
SYMBOL
δ
FROUDE NO.
CAV NO
0°
4°
8°
12°
16°
20°
6.123
.1 74
LIFT COEFFICIENT ~ C_L
DRAG COEFFICIENT ~ C_D
ANGLE OF


.95
NOTE DARKENED POINTS INDICATE VENTED FLOW
4°
8°
12°
-2
-1
LIFT COEFFICIENT - C_L
OF ATTACK - α - DEGREES
PITCHING MOMENT COEFFICIENT - $C_{M_{c/4}}$

WHIRLING TANK TEST N
BU SHIPS FOIL NO
MAC. .152 , S = 8.00 SQ IN
VELOCITY = 80 KTS

SYMBOL	δ	FROUDE NO	CAV NO
⊙	0°	5.32	.395
▲	4°		
■	8°		
◇	12°		
◇	16°		
▷	20°		





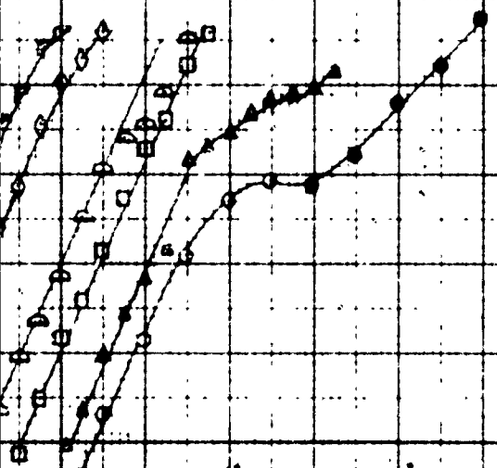
LIFT COEFFICIENT - C_L

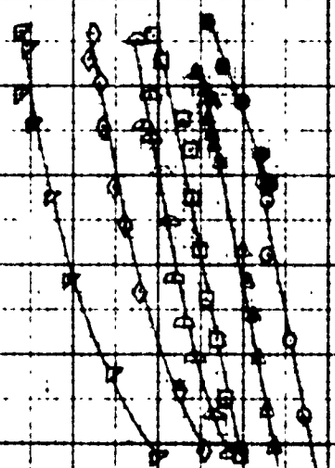
DRAG COEFFICIENT - C_D

ANGLE OF ATTA

T NO 42
NO 13
SQ IN a/c 1.00
KTS

NOTE DARKENED POINTS INDICATE VENTED FLOW

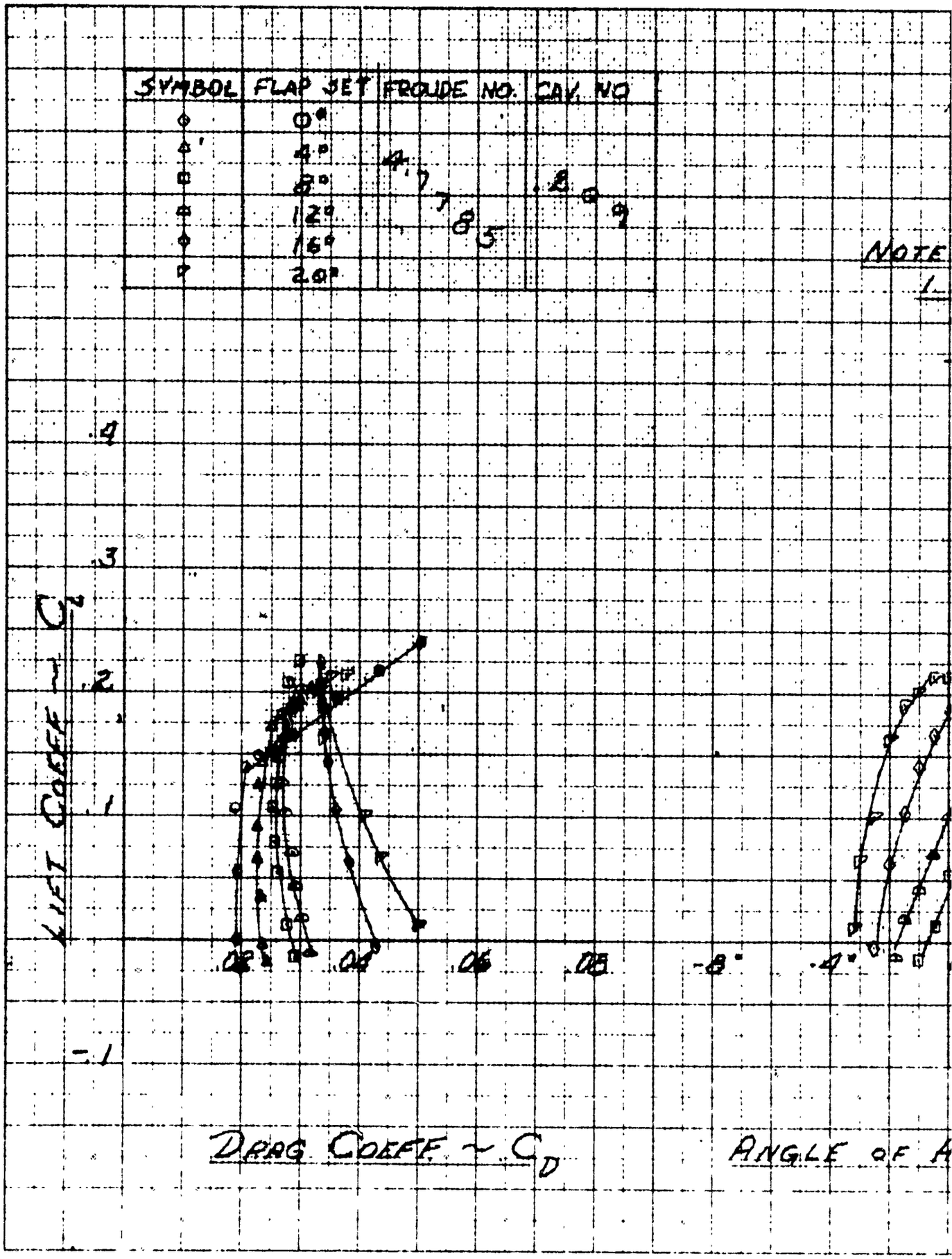




LIFT COEFFICIENT - C_L

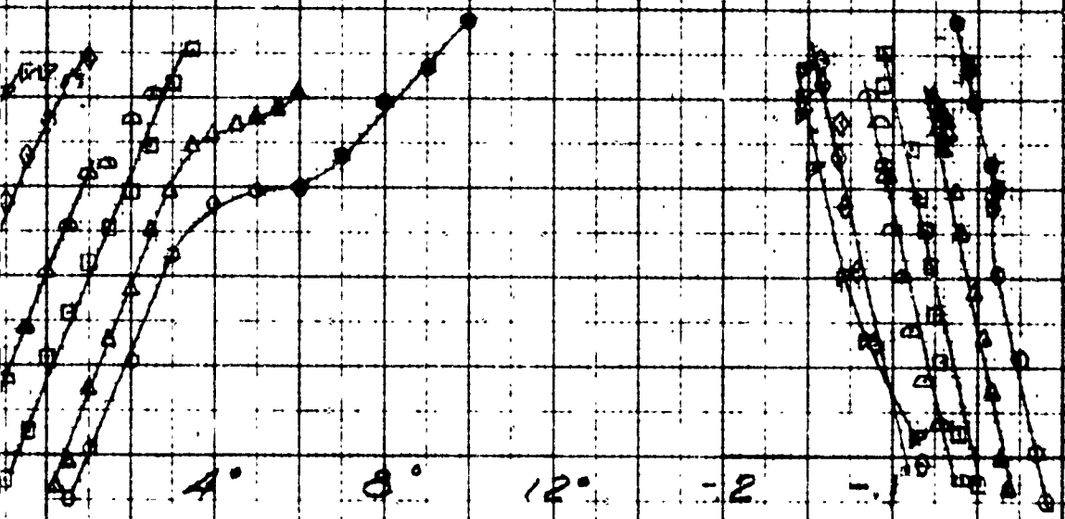
ATTACK - α - DEGREES

PITCHING MOMENT COEFFICIENT - $C_{M_{0.25}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV. NO
0°
4°
8°
12°
16°
20°
4.7
7
8
5
.8
0
9
NOTE
1
.4
.3
.2
.1
-.1
LIFT COEFF ~ C_L
.02
.04
.06
.08
-8°
-4°
DRAG COEFF ~ C_D
ANGLE OF A

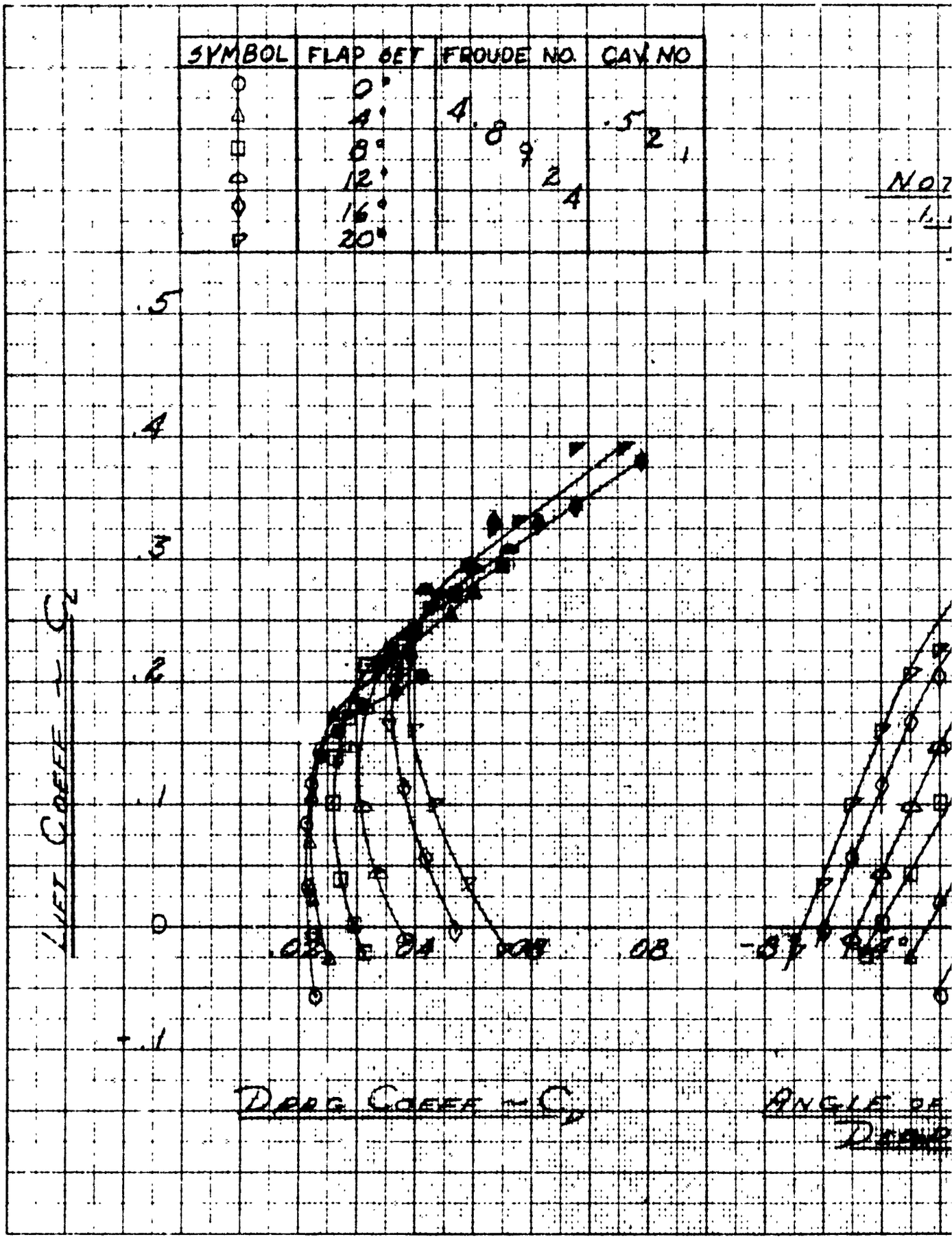
WHIRLING TANK TEST NO 42
BUSHIPS FOIL NO. 13
M.AC. = 4.52 FT. AREA = 8.50" ℓ/c = 1.25
VEL - 30.0 KTS

TE:
1. DARKENED SYMBOLS INDICATE VENTED FLOW.



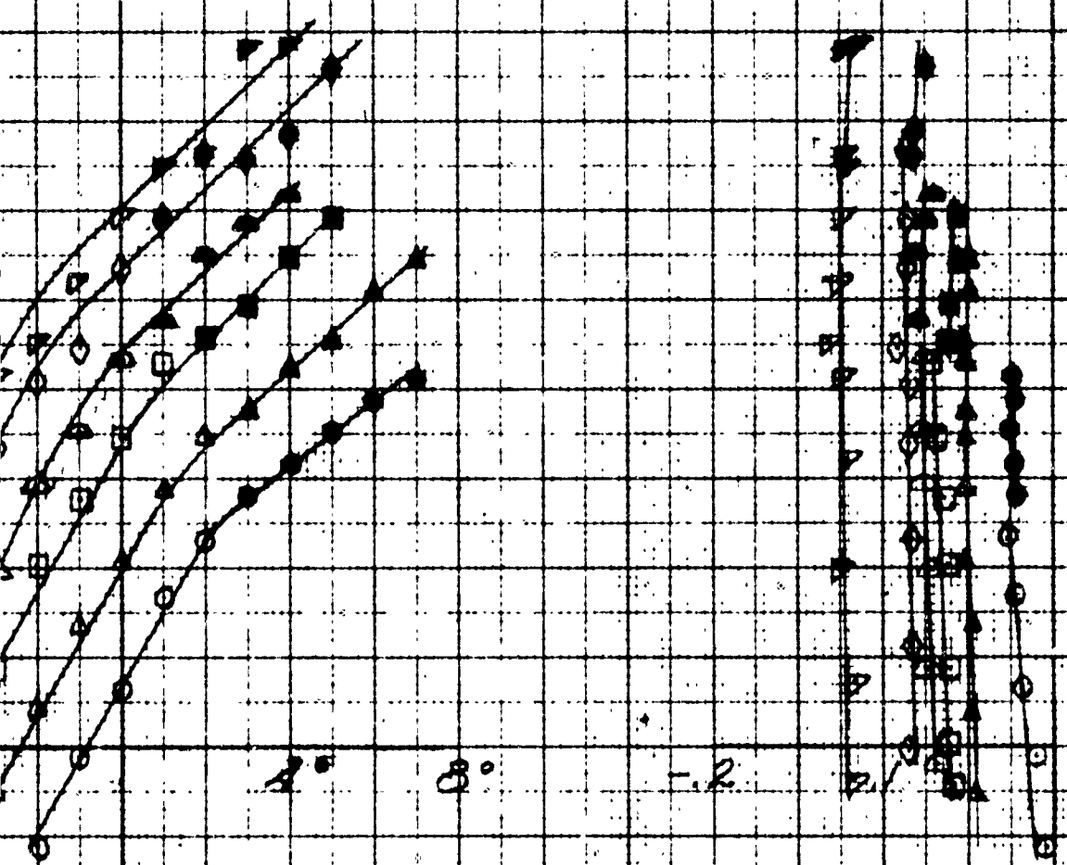
ATTACK ~ DEGREES

PITCHING MOMENT COEFF. ~ $C_{M_{c/4}}$


SYMBOL
FLAP SET
0°
4°
8°
12°
16°
20°
FROUDE NO.
4
6
9
2
4
CAV NO
.5
2
1
NOT
.5
.4
.3
.2
.1
0
+.1
LIFT COEFF - C_L
DRAG COEFF - C_D
ANGLE OF
DRAG

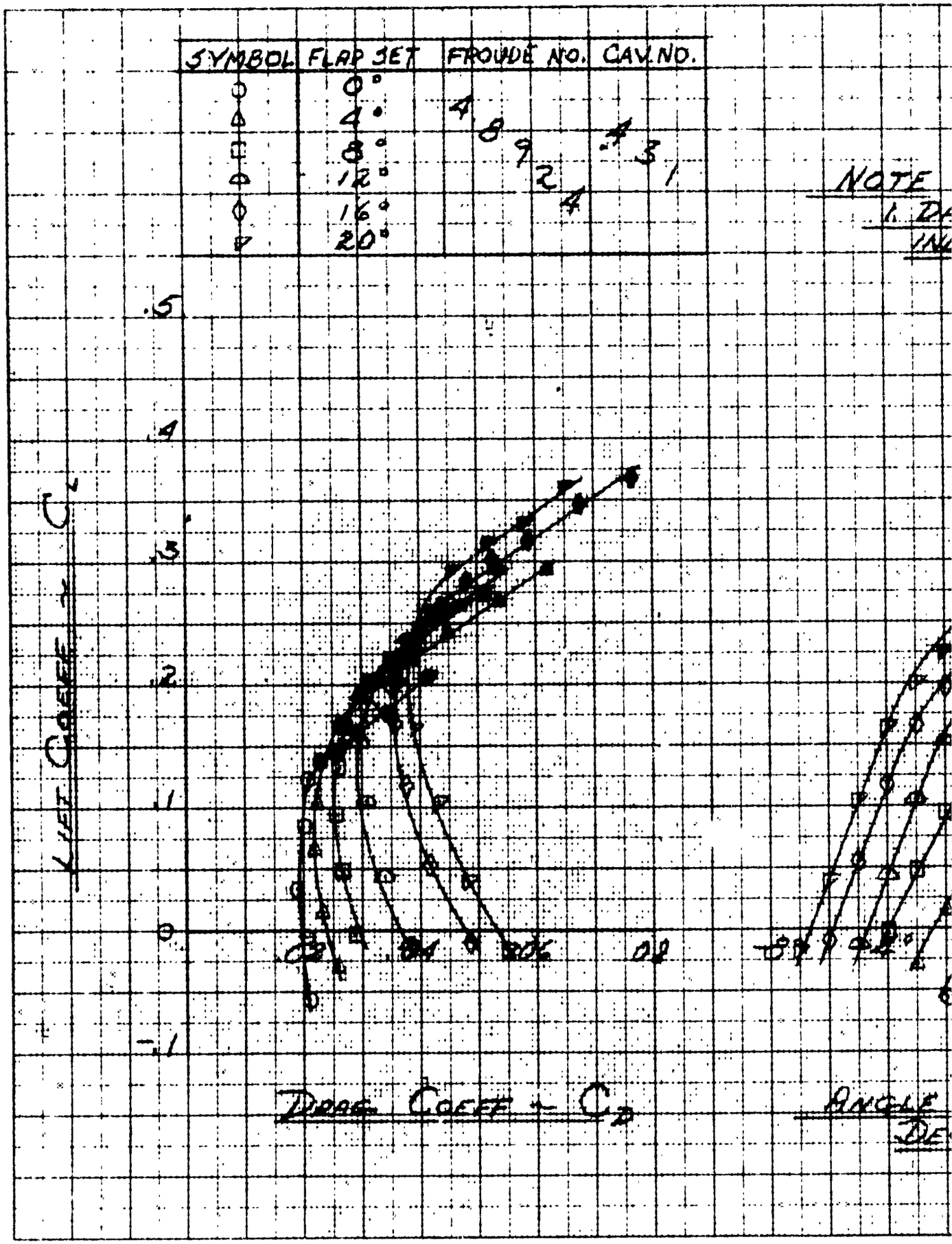
WHIRLING TANK TEST NO. 43
BUSHIPS FOIL NO. 14
M.A.C. = .182 FT AREA = 8.4"
ℓ/c = 1.00
V = 40 KTS

OTE:
1. DARKENED SYMBOLS
INDICATE VENTED FLOW.



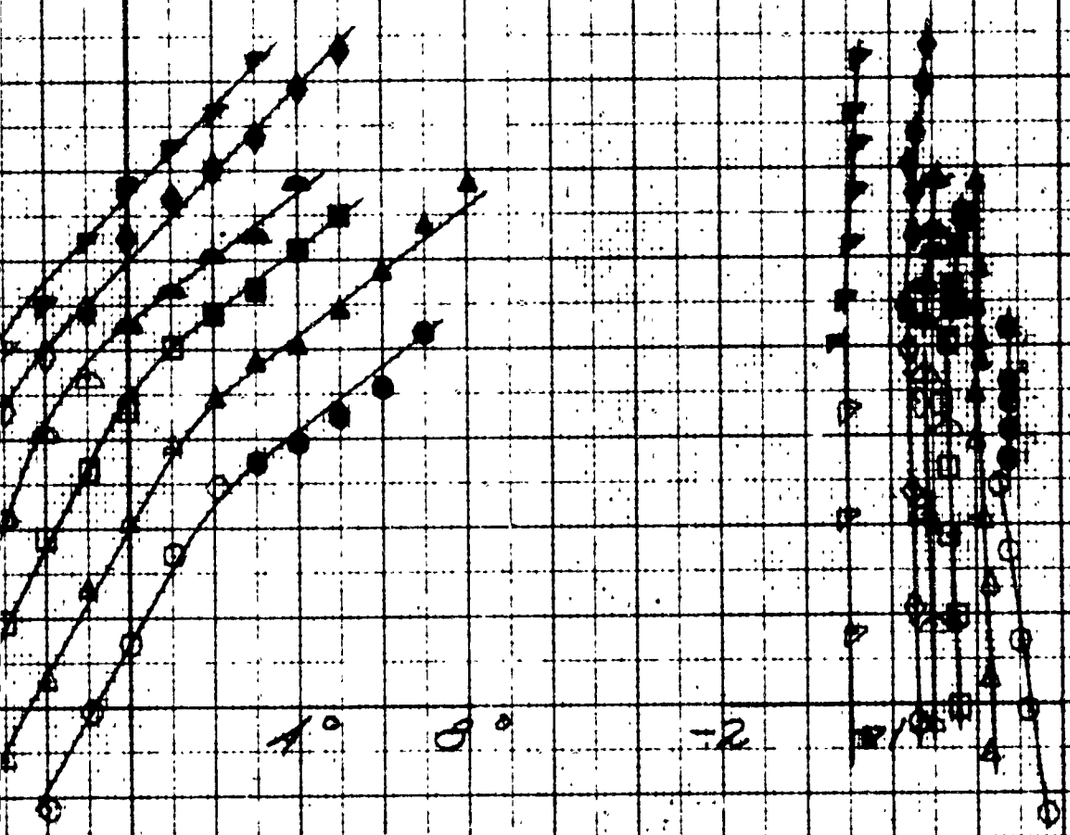
OF ATTACK
DEES

PITCHING MOMENT
COEFF ~ $C_{m_{c/4}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV. NO.
0°
4°
8°
12°
16°
20°
4
8
9
2
4
.4
3
1
NOTE
1. DA
IN
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF ~ C_L
.02
.04
.06
.08
DRAG COEFF ~ C_D
ANGLE
DE

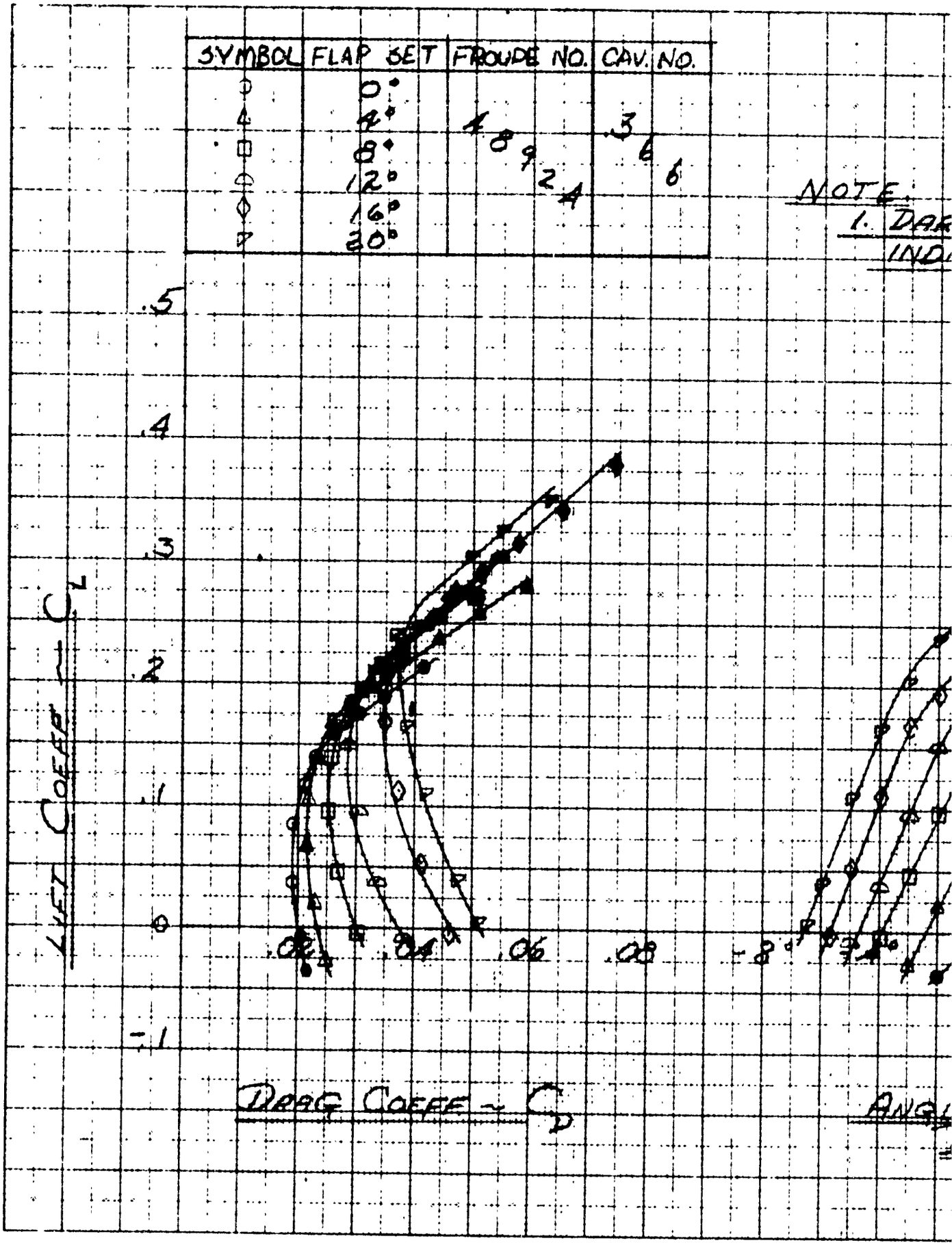
WHIRLING TANK TEST NO 43
BUSHIPS FOIL NO 14
MAC = .182 FT AREA = 84"
d/c = 1.00
VEL = 45 KTS

E
DARKENED SYMBOLS
INDICATE VENTED FLOW



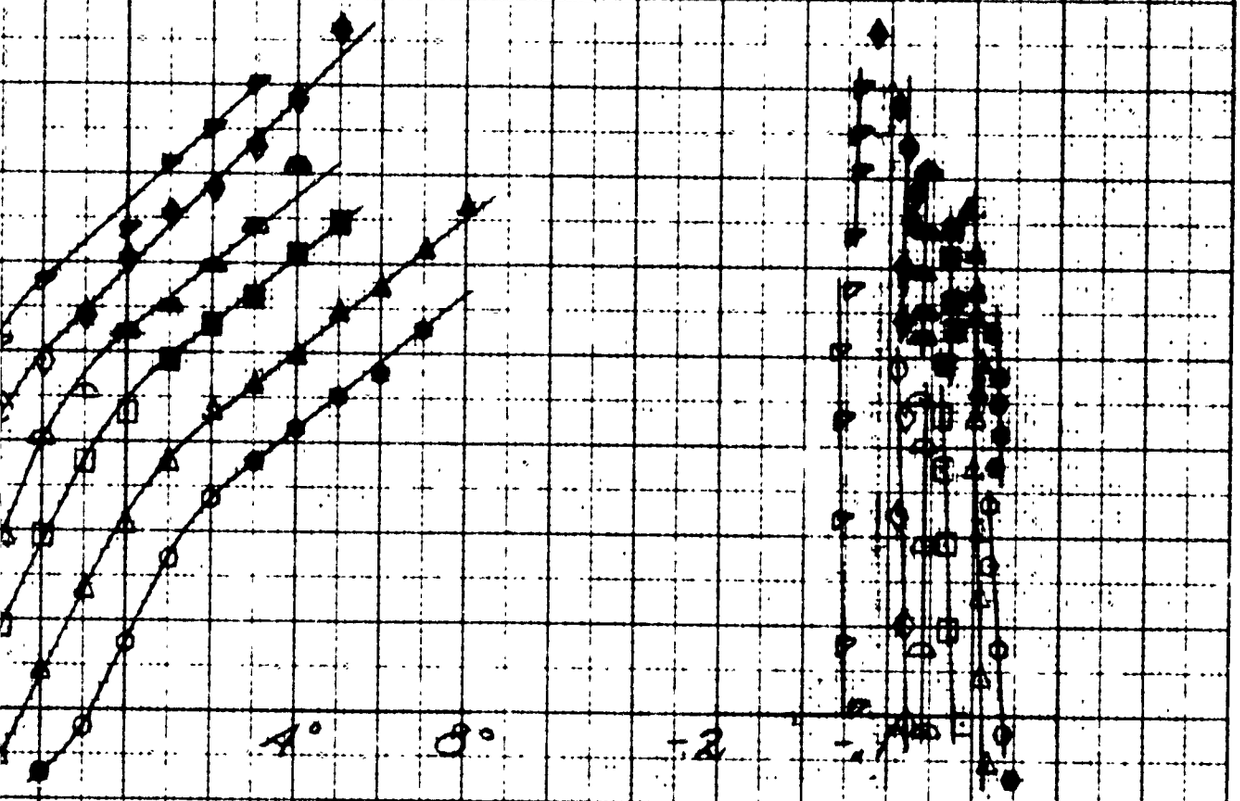
E OF ATTACK
DEGREES

PITCHING MOMENT
COEFF. ~ $C_{M_{c/4}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV. NO.
0°
4°
8°
12°
16°
20°
1.8
2.4
.3
.6
NOTE:
1. DAR
IND
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF - C_L
.02
.04
.06
.08
-8°
DRAG COEFF - C_D
ANG

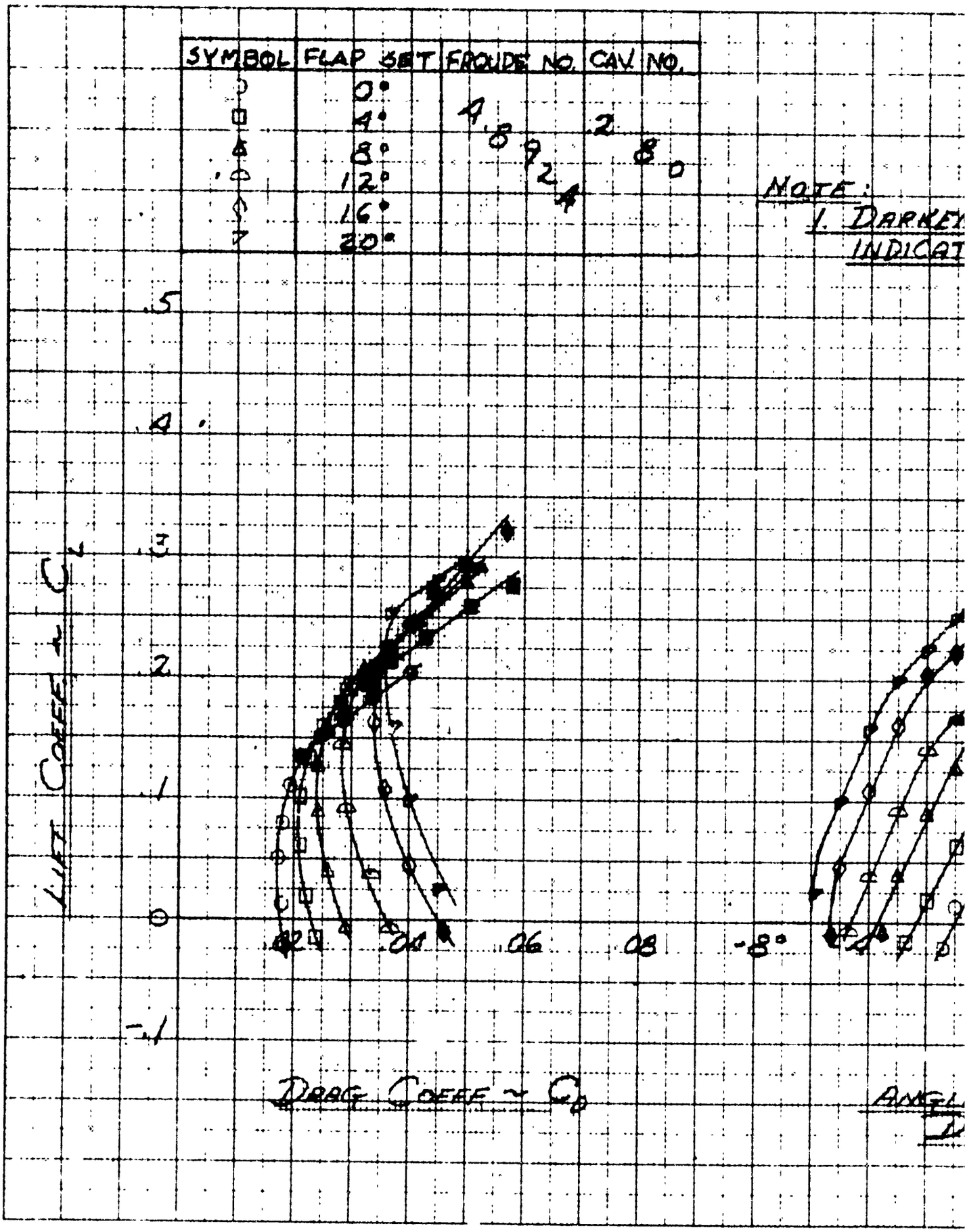
WHIRLING TANK TEST NO. 43
BuSHIPS FOIL NO. 14
M.A.C. = 1.82 FT. AREA = 8 SQ. FT.
$\ell/c = 1.00$
$V = 50$ KTS

ARKENED SYMBOLS
NDICATE VENTED FLOW



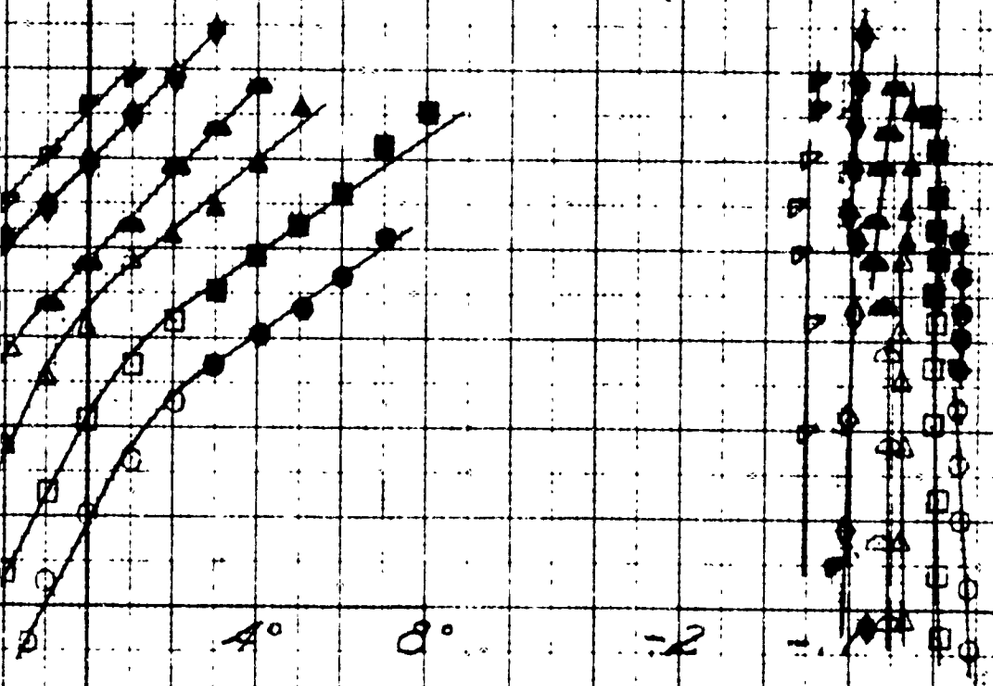
GLE OF ATTACK
DEGREES

PITCHING MOMENT
COEFF. - $C_{M_{c/4}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV. NO.
0°
4°
8°
12°
16°
20°
4.8
9
2.4
.2
.8
0
NOTE:
1. DARKEN
INDICAT
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF. ~ C_L
.02
.04
.06
.08
-8°
DRAG COEFF ~ C_D
ANGL

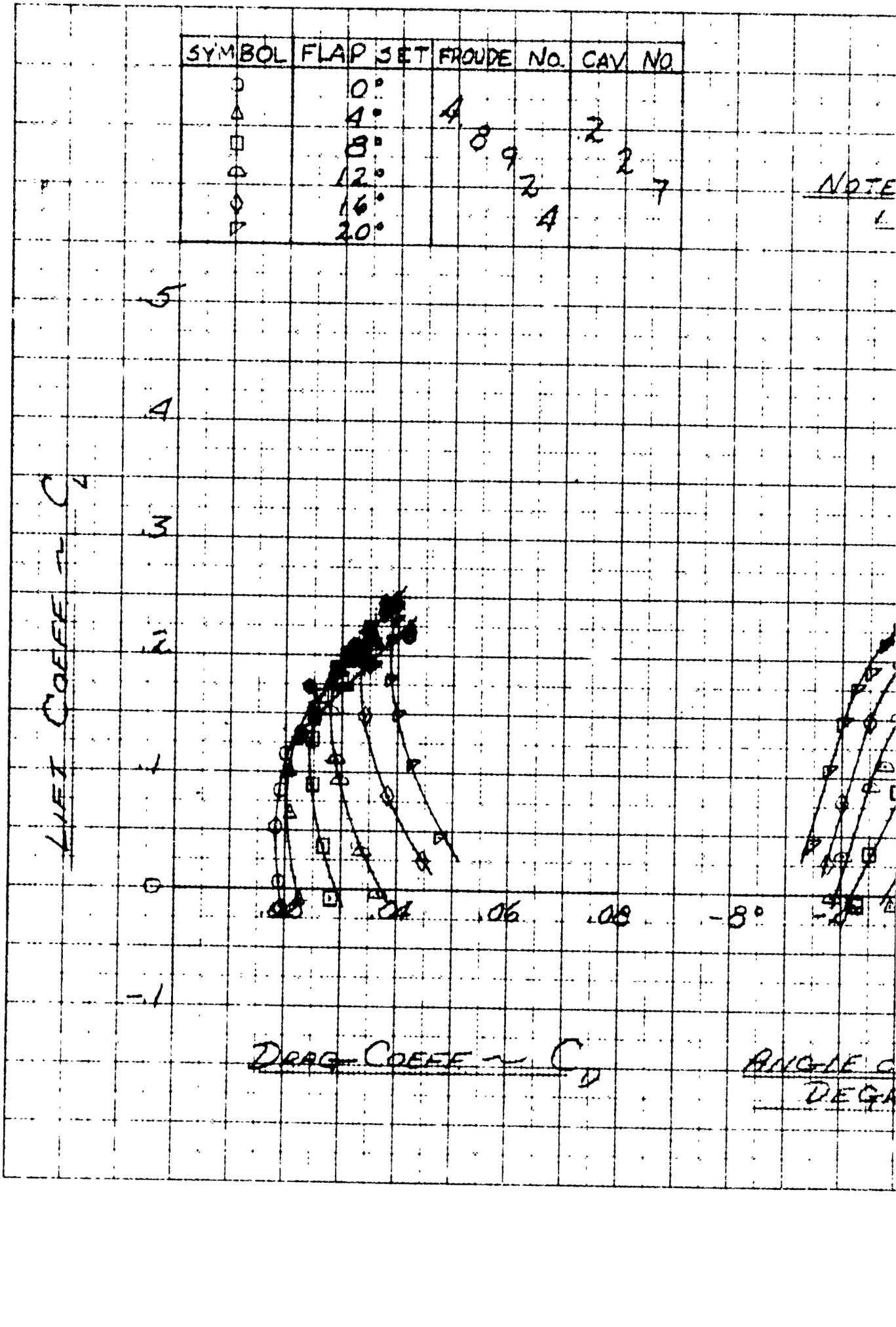
WHIRLING TANK TEST NO. 43
BUSHIRS FOIL NO. 14
M.A.C. = 1.82 FT AREA = 8 □"
ℓ/c = 1.00
V = 60 KTS

KENED SYMBOLS
ATE VENTED FLOW



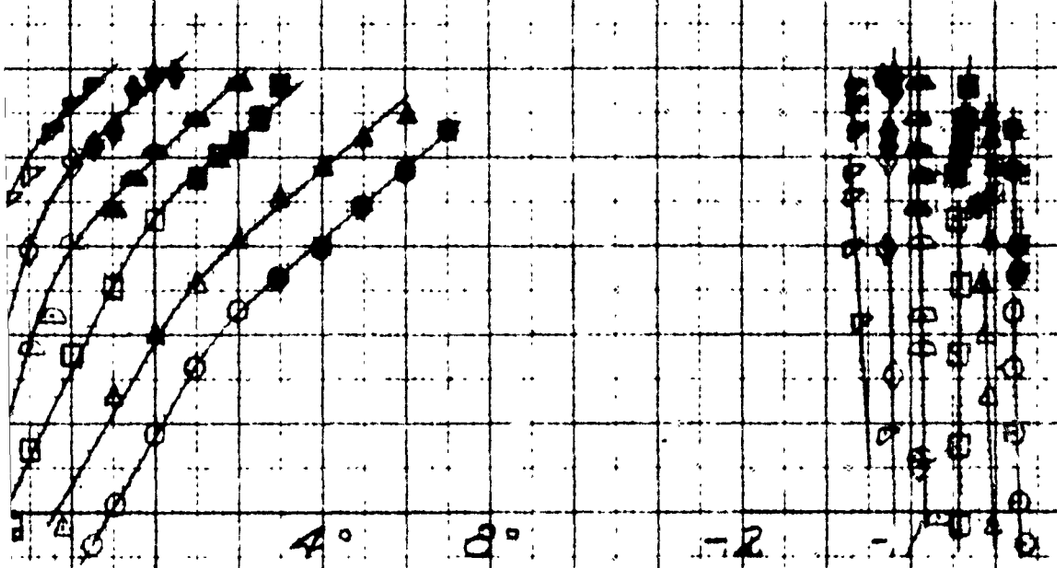
GLE OF ATTACK
DEGREES

PITCHING MOMENT
COEFF ~ $C_{M_{c/4}}$


SYMBOL
FLAP SET
0°
4°
8°
12°
16°
20°
FROUDE No.
4
8
9
2
4
CAV No.
2
2
7
NOTE
LIFT COEFF ~ C_L
5
4
3
2
1
0
-1
.04
.06
.08
-8°
DRAG COEFF ~ C_D
ANGLE
DEG

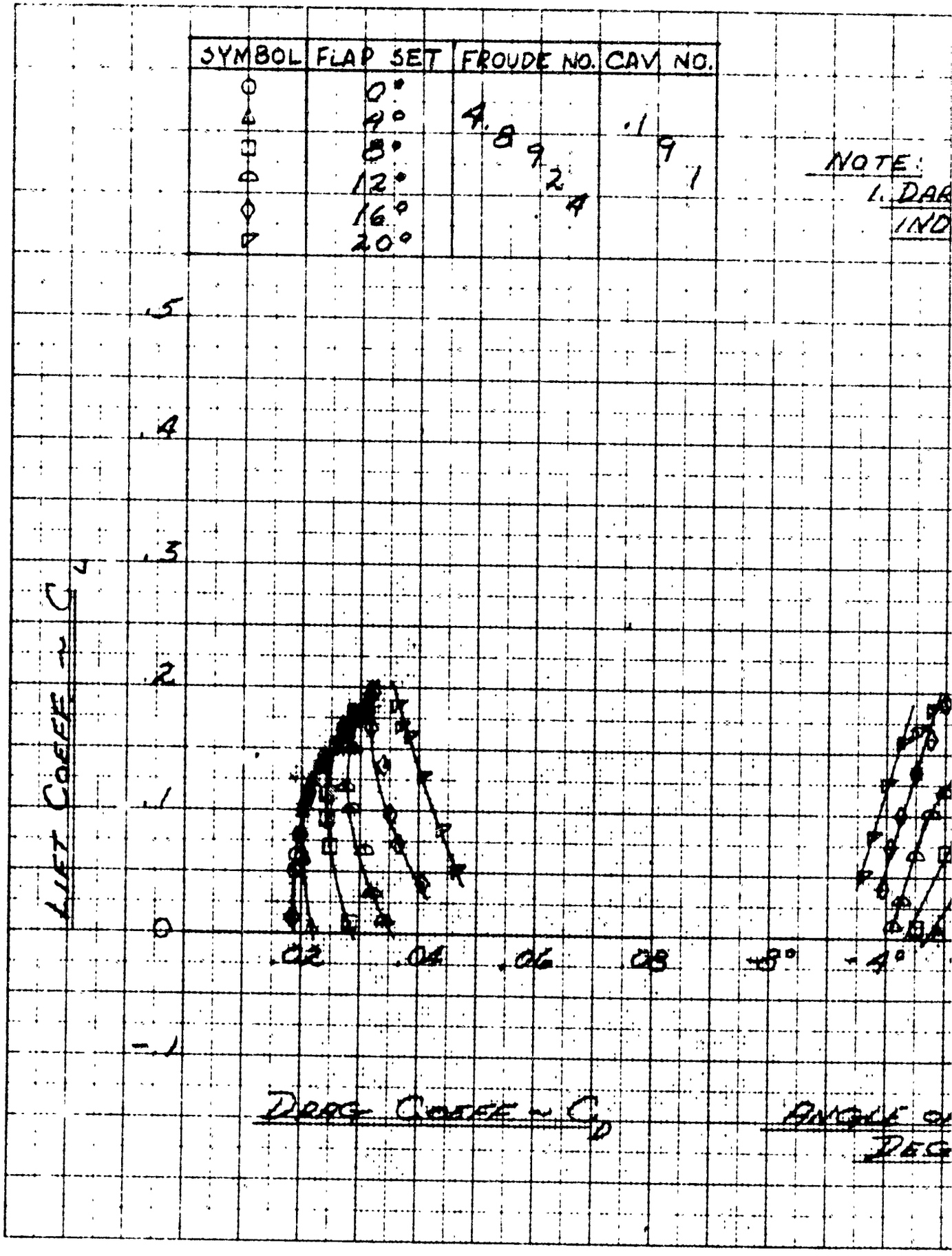
WHIRLING TANK TEST No. 43
BUSHIPS FOIL No. 14
M.A.C = .182 FT AREA = 8 □"
d/c = 1.00
$\sqrt{\ }$ = 70 KTS

TE:
1. DARKENED SYMBOLS
INDICATE VENTED FLOW



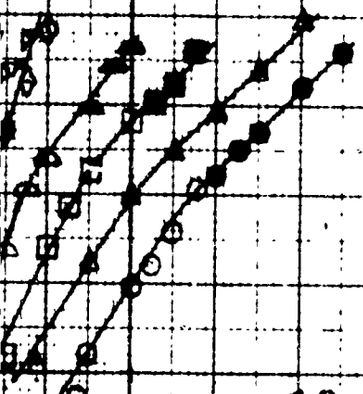
CF ATTACK
GREES

PITCHING MOMENT
COEFF ~ $C_{M_{c/4}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV NO.
0°
4°
8°
12°
16°
20°
4.8
.1
9
9
2
1
4
NOTE:
1. DAR
IND
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF ~ C_L
.02
.04
.06
.08
-8°
-4°
DRAG COEFF ~ C_D
ANGLE OF
DRAG

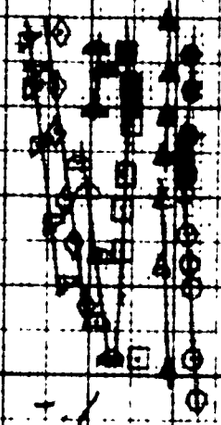
WHIRLING TANK TEST NO. 43
BUSHIPS FOIL NO. 14
M.A.C. = .182 FT AREA = 8 SQ IN
$\frac{d}{c}$ = 1.00
V = 80 KTS

DARKENED SYMBOLS
INDICATE VENTED FLOW



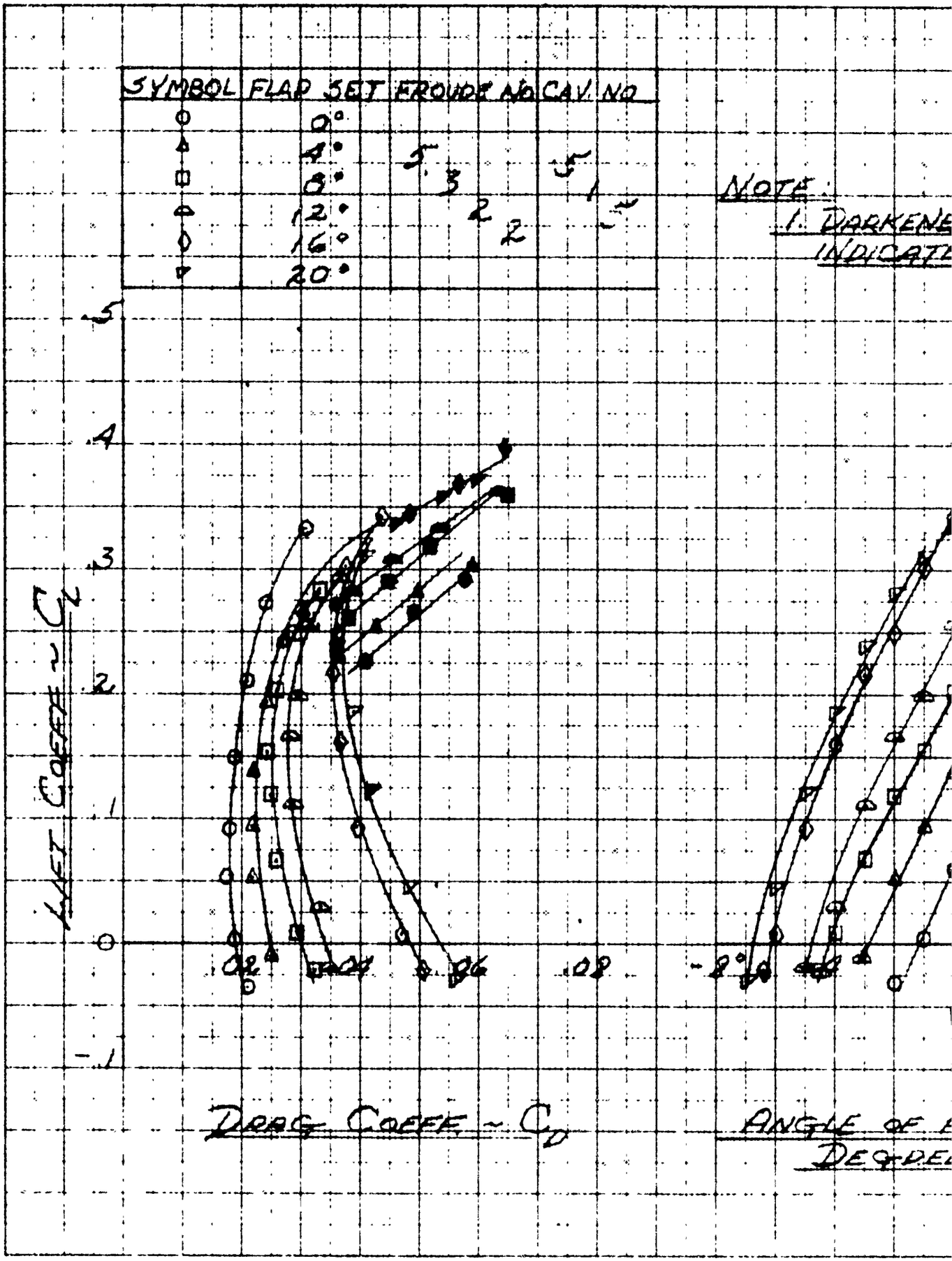
4°

OF ATTACK
DEGREES



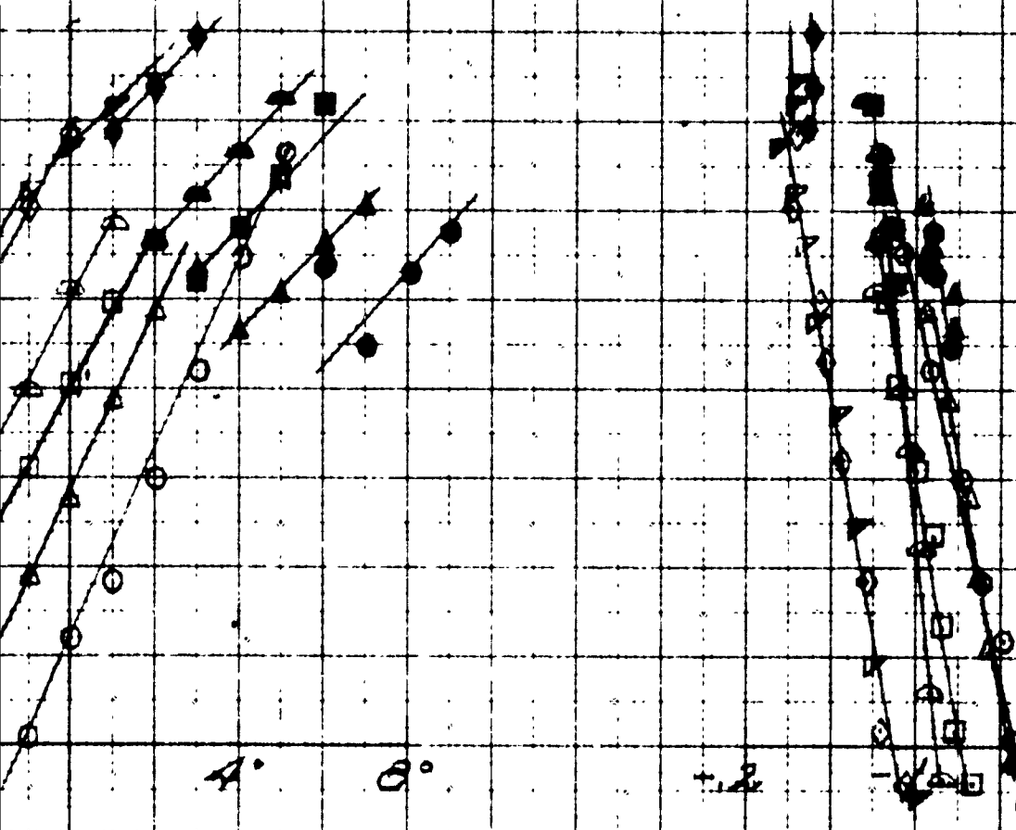
-.2 +.1

PITCHING MOMENT
COEFF - $C_{M_{CG}}$


SYMBOL FLAP SET FROUDE NO CAV. NO
0°
4°
8°
12°
16°
20°
5
3
2
2
.5
1.5
NOTE:
1. DARKENE
INDICATI
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF ~ C_L
.02
.04
.06
.08
-2°
DRAG COEFF ~ C_D
ANGLE OF
DEGREE

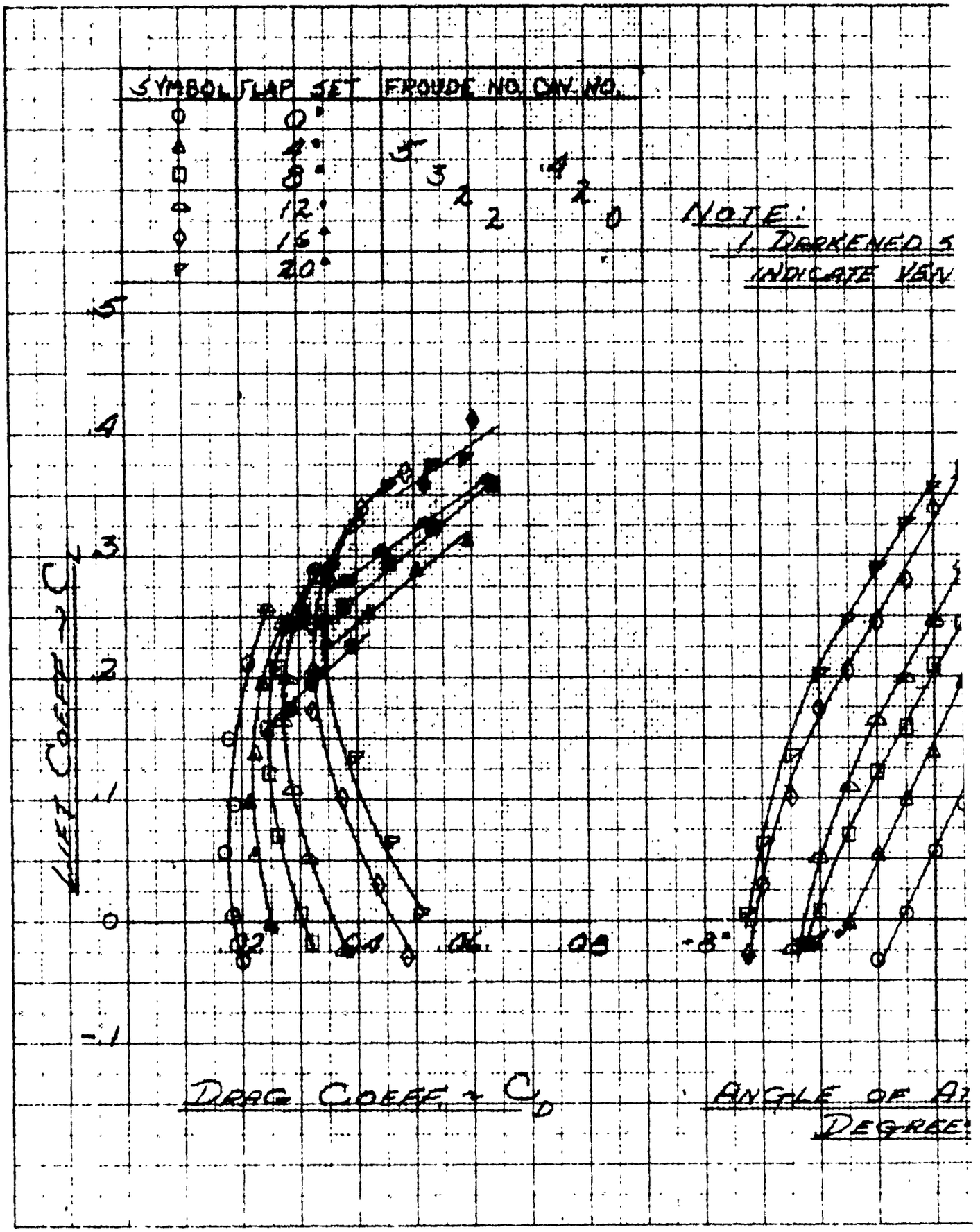
WHIRLING TANK TEST NO. 40
BUSHIDO FOIL NO. 15
M.A.C. = 152 FT. AREA = 80"
t/c = 1.00 V = 40 KTS

ENED SYMBOLS
ATE VENTED FLOW



F ATTACK
DEES

PITCHING MOMENT
COEFF. - $C_{M_{c/4}}$


SYMBOL
FLAP SET
FROUDE NO.
CAV. NO.
0°
4°
8°
12°
16°
20°
5
3
2
2
4
2
0
NOTE:
1. DARKENED S
INDICATE VEN
.5
.4
.3
.2
.1
0
-.1
LIFT COEFF ~ C_L
.02
.04
.06
.08
-8°
DRAG COEFF ~ C_D
ANGLE OF AT
DEGREE

WHIRLING TANK TEST NO 4

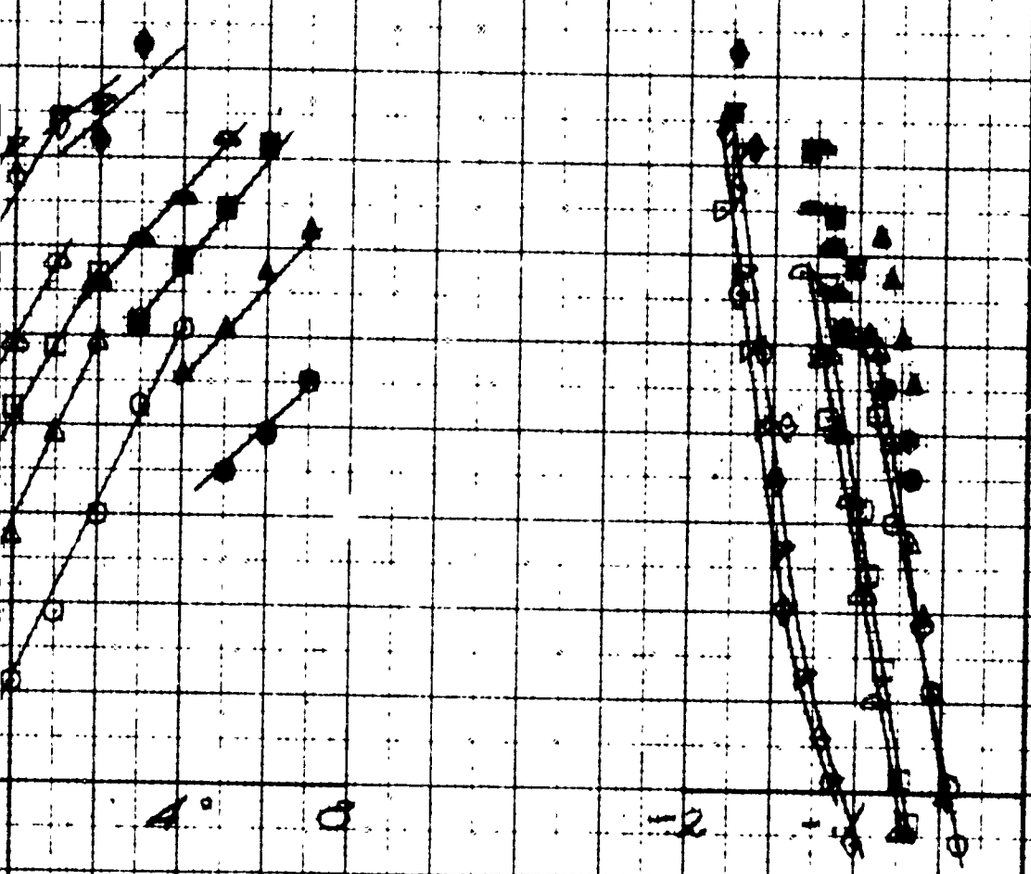
BuSHIPS FOIL NO. 15

M.A.C. = .152 FT. AREA = 8 □"

d/c = 1.00 V = 45 KTS

SYMBOLS

ENTED FLOW.

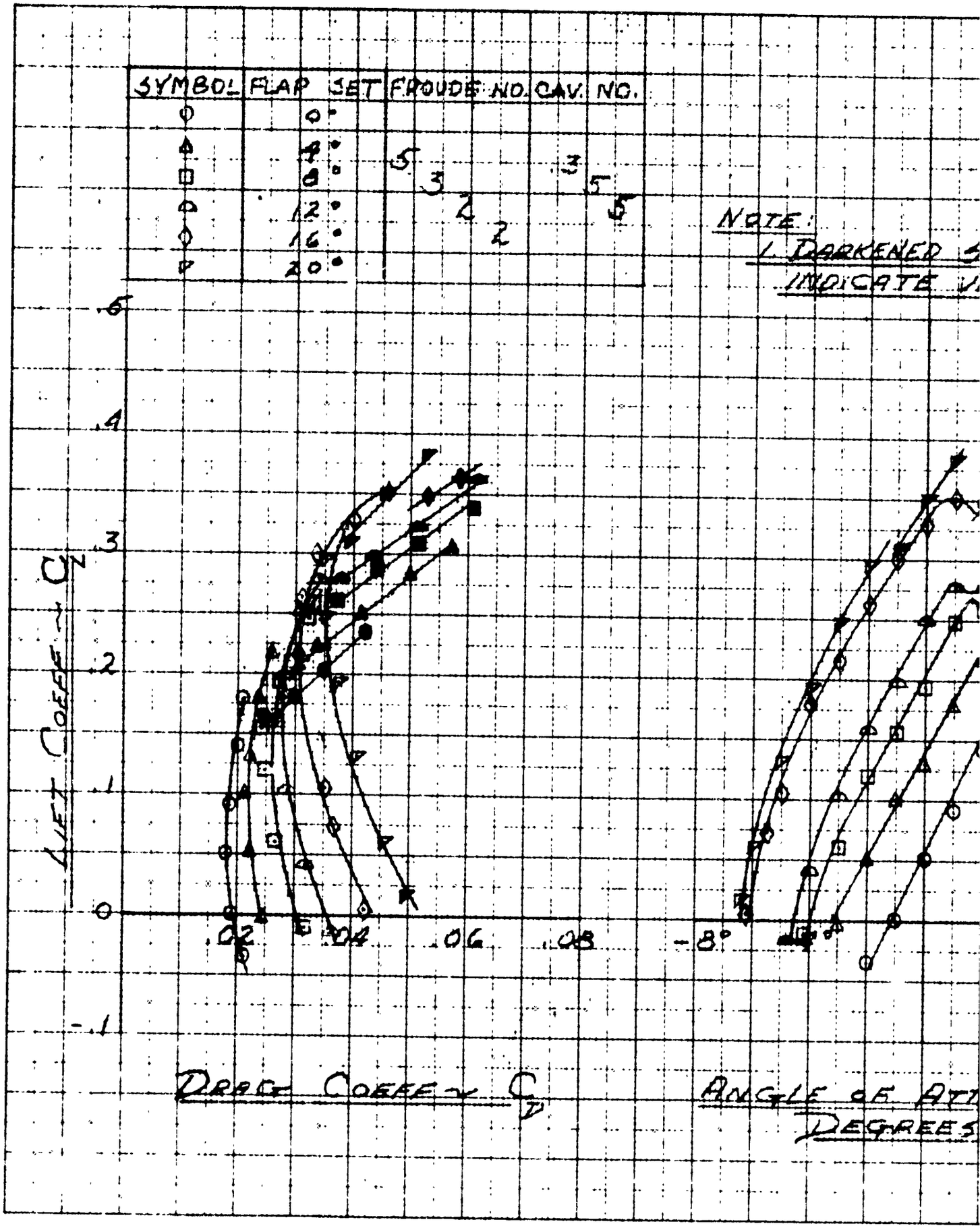


ATTACK

ES

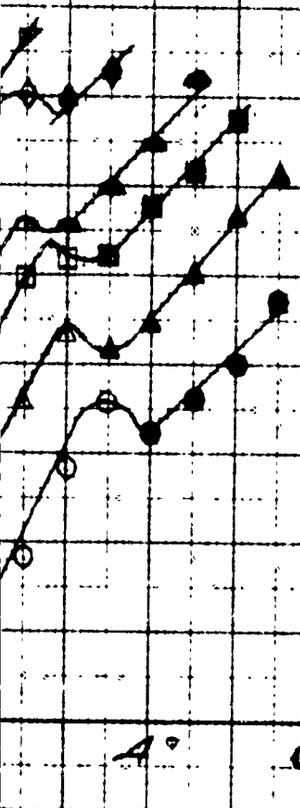
PITCHING MOMENT

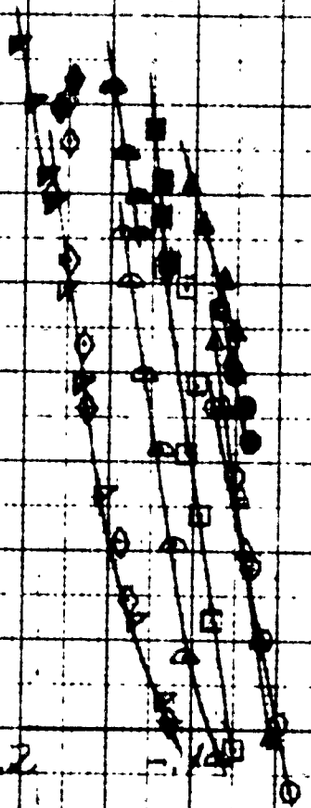
COEFF. ~ $C_{M_{c/4}}$


SYMBOL FLAP SET FROUDE NO. CAV. NO.
0°
4°
8°
12°
16°
20°
5
3
2
2
3
5
5
NOTE:
1. DARKENED
INDICATE
.6
.4
.3
.2
.1
0
-.1
LIFT COEFF. C_L
.02
.04
.06
.08
-8°
DRAG COEFF. C_D
ANGLE OF ATT
DEGREES

WHIRLING TANK TEST No. 84
BUSHIAS FOIL NO 15.
MAC = .152 FT AREA = 8.00 □"
d/c = 1.00 V = 50 KTS

SYMBOLS
VENTED FLOW.



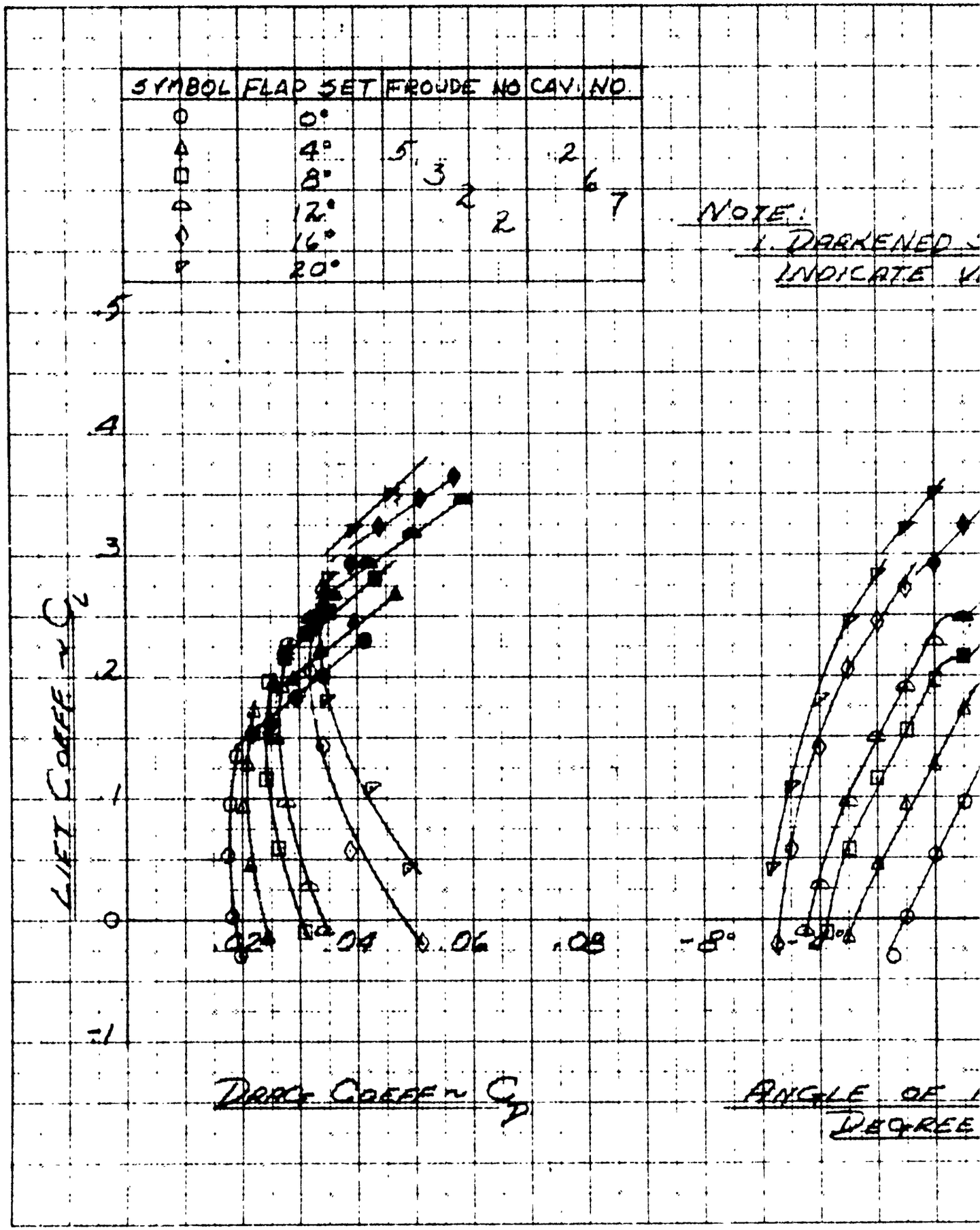


4° 8°

-.2 -.1

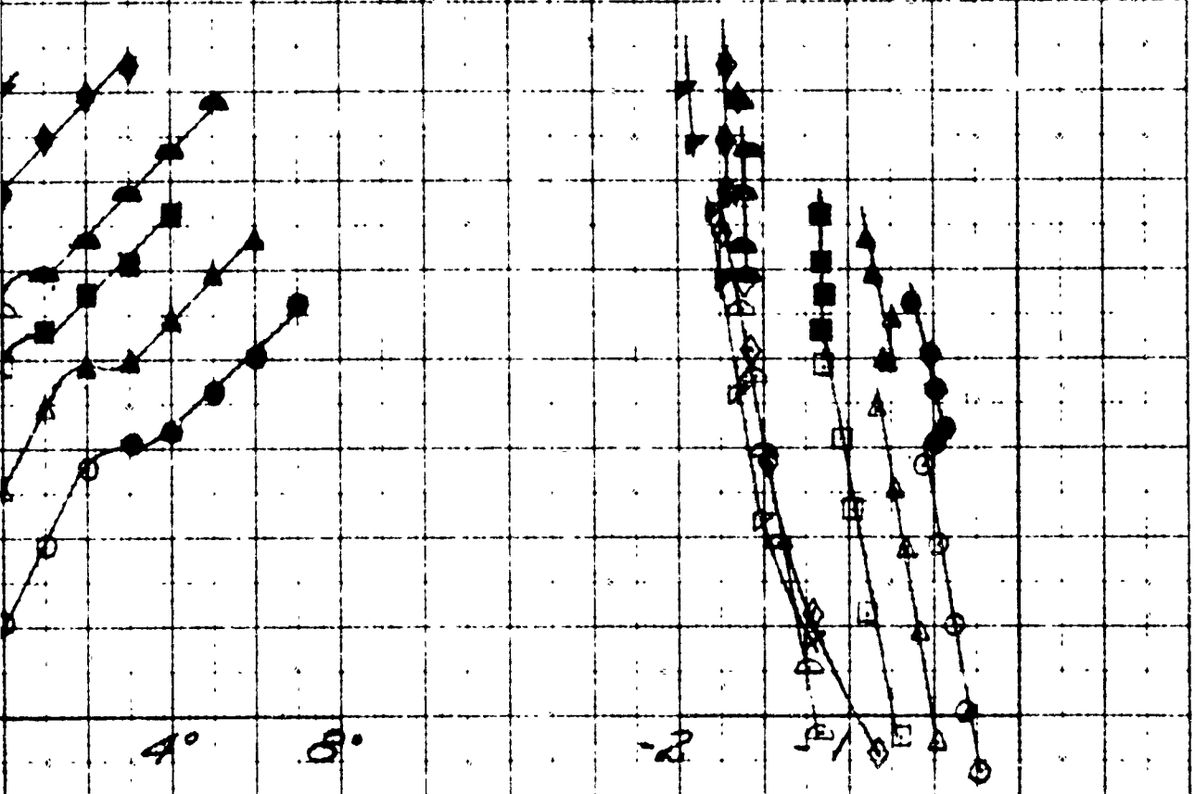
ATTACK
ES

PITCHING MOMENT
COEFF. ~ $C_{M_{c/4}}$


SYMBOL
FLAP SET
FROUDE NO
CAV. NO.
0°
4°
8°
12°
16°
20°
5
3
2
2
2
6
7
NOTE:
1. DARKENED
INDICATE
5
4
3
2
1
0
-1
LIFT COEFF = C_L
.02
.04
.06
.08
-8°
-6°
DRAG COEFF = C_D
ANGLE OF
DEGREE

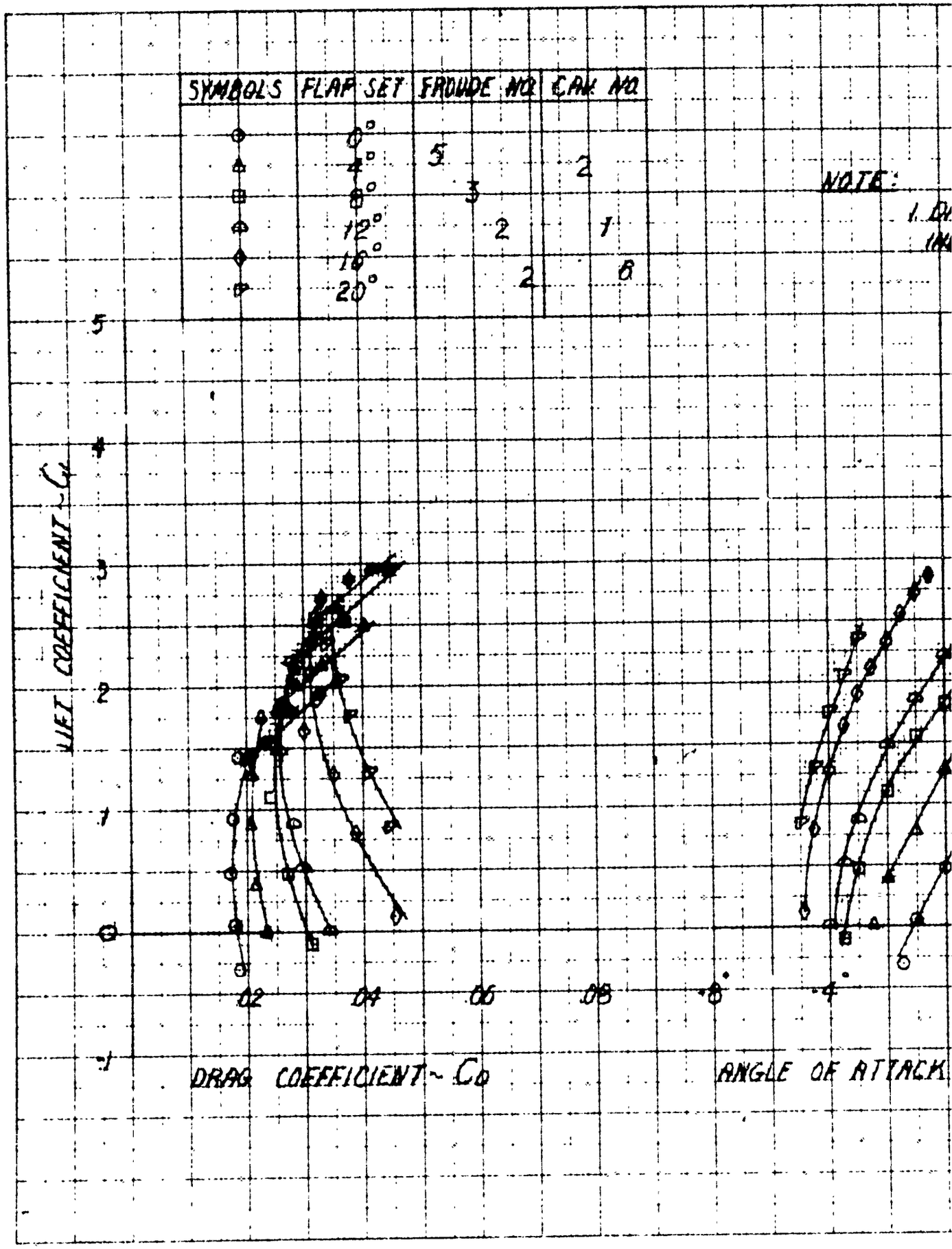
WHIRLING TANK TEST NO. 44
BUSHIPS FOIL NO. 15
M.A.C. = .152 FT AREA = 8 □"
d/c = 1.00 V = 60 KTS

D SYMBOLS
VENTED FLOW.



ATTACK
EES

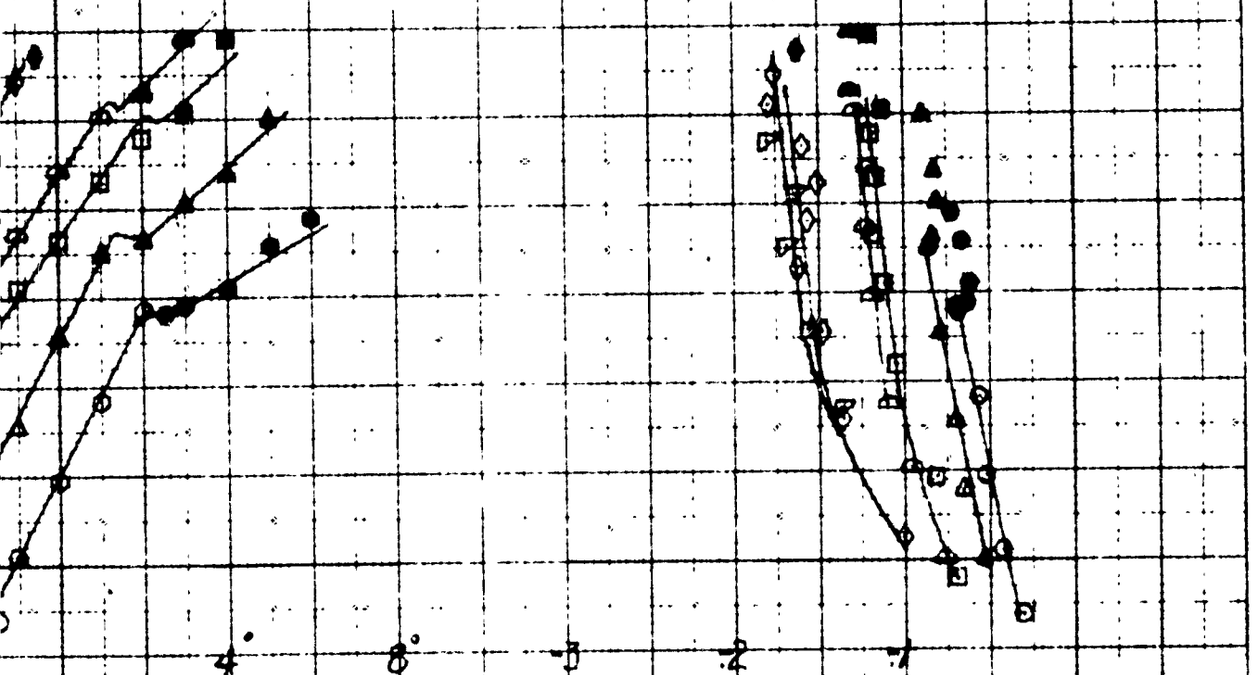
PITCHING MOMENT
COEFF ~ $C_{M_{1/4}}$


SYMBOLS
FLAP SET
FROUDE NO
CAM NO
0°
4°
8°
12°
16°
20°
5
3
2
2
2
1
6
NOTE:
1. DA
IN
LIFT COEFFICIENT - C_L
5
4
3
2
1
0
-1
.02
.04
.06
.08
DRAG COEFFICIENT - C_D
-8
-4
ANGLE OF ATTACK

WHIRLING TANK TEST NO 44
BU SHIPS FOIL NO 15
M.A.C. = .152 S = 8.00 IN²

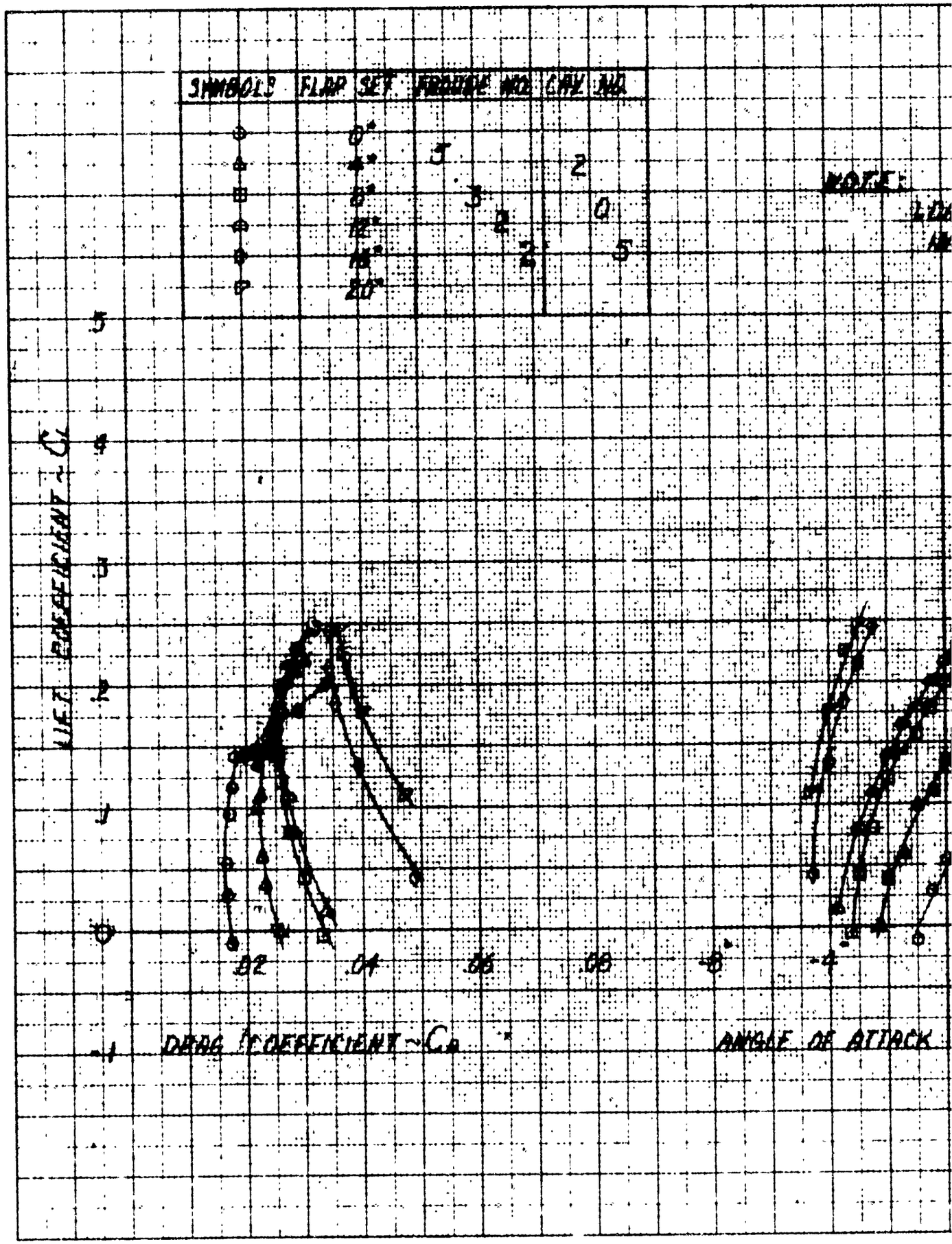
$d_{/c}$ = 1.00 V = 70 KTS.

1. DARKENED SYMBOLS INDICATE VENTED FLOW.



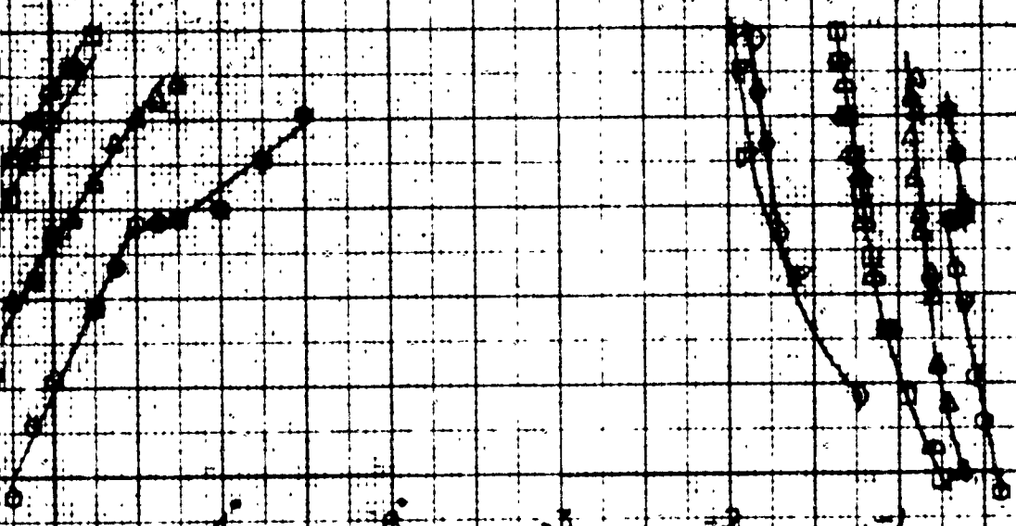
PITCH ~ α - DEGREES

PITCHING MOMENT COEFFICIENT
$C_{m\,c/4}$


SYMBOLS
FLAP SET
0°
5°
10°
15°
20°
NOTE:
LIFT COEFFICIENT - C_L
DRAG COEFFICIENT - C_D
ANGLE OF ATTACK
.02
.04
.06
.08
-8
-4

WHIRLING TANK TEST NO. 44
BU. SHIPS FOIL NO. 15
MAC = .052 FT. S = 0.00 FT.²
d/c = 1.00 V = 80 KTS.

DARKENED SYMBOLS
INDICATE VENTED FLOW.



K -α DEGREES

PITCHING MOMENT COEFFICIENT
C_M -4